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Plan To Expedite Wood Pulp Shipments

Joint Efforts of State Department, German Government and American Importers of Scandinavian Wood Pulp Expected To Remedy Shipping Difficulties — Germany Expected To Accept Non-Re-Export Affidavits.

A plan to expediate shipments of wood pulp to this country has been effected through the joint efforts of the State Department, the German Government, and American importers of Scandinavian pulp. This has been accomplished, Carlton B. Overton, of Castle & Overton, Inc., and former president of the Association of American Wood Pulp Importers said, through the use of non-re-export affidavits. It is hoped that affidavits, signed by American consignees, will be accepted by the German Government as evidence that the pulp is for use in this country and not to be re-exported to countries hostile to Germany.

How the Plan Operates

The plan operates as follows: When a steamer with a full cargo of wood pulp consigned to this country is ready to sail, or has been detained for examination by Germany, the Sulphite Suppliers of the World, which includes producers in Scandinavian and Central European countries, cable to the Association of American Wood Pulp Importers a list of consignees, the cargo specifications and the name of the ship. Owing to the complications which would obviously result in an attempt to include mixed cargoes in such a plan, only full cargoes of wood pulp are covered by this arrangement.

On receipt of the information the American association communicates with the consignees and obtains from them affidavits of non-re-export, which are sent to the Swedish Legislation in Washington, which delivers them to the State Department for transmission by cable to competent authorities abroad. If a ship is detained, the State Department informs the American Consul at Hamburg, Germany, that it possesses the affidavits covering the cargo and the Consul presents this evidence of non-re-export to the German authority having jurisdiction over the seized vessel.

A similar method is followed when ships clear from Scandinavian ports, in which case the State Department of the United States advises its nearest legation to the point of departure that it possesses affidavits. The American Legation then delivers to the captain of the ship a certificate showing that affidavits of non-re-export are held by the State Department. With this certificate, the master of the ship has evidence to present to the captain of any German ship which halts him for examination that the entire cargo is consigned to the United States and will be used in this country.

At the present time, Mr. Overton said, some fifteen ships laden with wood pulp are being detained by Germany and affidavits are being prepared to release them for clearance to this country. It is expected that this use of non-re-export affidavits will solve the difficult shipping problem now hampering the delivery of wood pulp to United States ports.

The German Consulate in New York, Mr. Overton said, has extended the fullest cooperation to the State Department and the Association to further the successful operation of the clearance system.

Norwegian Shipments Not Included

Thus far Finnish shipments have been handled in a similar manner except that since almost all pulp imports from that country are handled by a single N. Y. firm they have worked directly through the Finnish legation and the United States State Department. Since Norwegian shipments pass through waters not controlled by Germany it has not yet been necessary to include them in this plan.

The Association of American Wood Pulp Importers is not confining its activities in this matter to its own membership but will extend its facilities to all pulp importing firms who desire to cooperate.

Government Paper Bids

WASHINGTON, D. C., December 13, 1939—The Government Printing Office has received the following bids for 10,000 pounds of buff ledger paper: Walker, Goulard Plehn Company, 13.75 cents; Aetna Paper Company, 9.833 cents; Baxter Paper Company, 10.35 cents; Whitaker Paper Company, 9.52 cents; Barton, Duer & Koch Paper Company, 10.45 cents; Paper Corp. of U. S., 10.53 cents; Old Dominion Paper Company, 10.597 cents; and R. P. Andrews Paper Company, 10.17 cents.

For 5,042 pounds of blue ledger paper: Walker Goulard Plehn Company, 13.75 cents; Aetna Paper Company, 9.833 cents; Baxter Paper Company, 10.25 cents; Whitaker Paper Company, 9.52 cents; Barton, Duer & Koch Paper Company, 10.45 cents; Paper Corp. of U. S., 10.53 cents; Old Dominion Paper Company, 10.597 cents; and R. P. Andrews Paper Company, 10.61 cents.

For 28,000 pounds (100,000 sheets) of 22½ x 28½ jute tag board; Mudge Paper Company, 8.2 cents; Whitaker Paper Company, 8.06 cents; and Mathers-Lamm Paper Company, 11.25 cents.

Consolidated To Expand Its Production

Output of Coated Papers To Be Increased Up To 400 Tons Daily By Consolidated Water Power and Paper Company In February, 1940—Pulp Mills Expect More Orders—To Study Pulpwood Supply—Other News.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., December 11, 1939—Production of coated papers will be stepped up to 400 tons per day by Consolidated Water Power and Paper Company in February, 1940. No. 1 machine at the main mill at Wisconsin Rapids, one of the two original paper machines started by the company in 1904, will be rebuilt so it can be converted over to utilize Consolidated's patent process of coating the paper at the same time it is manufactured. Orders have been placed with Beloit Iron Works and Nekoosa Foundry and Machine Works for the equipment necessary to build in the coating section, and the work is being done by the company's own engineers and operating department. An added installation also was started at the Biron, Wis. mill early in November.

Rebuilt Machine to Produce 65 Tons Daily

The No. 1 machine will be ready for operation in February, and is expected to produce 65 tons per day. The company also contemplates extending the No. 2 machine and adding dryers within the next year, to increase its output. The latter machine has been on coated paper for the last three years.

Other changes which go with enlargement of facilities are the construction of a 40-foot extension to the clay storage shed, moving of the storage room in the main mill proper to the large central warehouse, and a rearrangement of locker rooms.

Since launching the filming process in 1933, Consolidated has found the demand for its coated papers increasing, keeping pace with the picture magazine vogue, where these glossed papers turned out on a mass production basis meet the demand. With completion of the present alterations, there will be six machines operating on coated stock.

To Study How to Increase Pulpwood Supply

Methods by which an increased supply of pulpwood and other industrial woods may be obtained from Wisconsin, Minnesota and Michigan will be studied by the joint Congressional committee on forestry at public hearings at the capitol at Madison, Wis., December 18 and 19, according to announcement of Senator John J. Bankhead of Alabama, chairman.

The committee intends to determine how the 52,500,000 acres of land capable of producing timber in the Lake States area can be regulated so as to increase the output. Within the last few years, 60 per cent of the timber requirements have come from other states, it is pointed out.

"This section of the country has experienced the rapid growth and decline of the forest industry attendant upon cutting practices not geared to productive capacity of the lands, "Senator Bankhead said, "and the committee looks forward to securing the well-considered testimony of its spokesmen."

The United States Forest Products Laboratory, located at Madison, is expected to be of considerable help to the committee, since its research staff has made extensive studies, and also has been seeking new uses for wood.

Reports of the sessions will be submitted to Congress, perhaps with a plan for public control "adequately to protect private as well as the broad public interests in all forest lands." The joint forestry committee was appointed by President Roosevelt last year to study present and prospective conditions in each of the timber producing regions of the country.

Pulp Mills Expecting More Business

Wisconsin pulp mills are looking for a further increase in demand due to the turn of affairs in Europe. Scandinavian pulp was coming through fairly well with Russian help to run the Baltic blockade, but it is believed the conflict between Russia and Finland will shut off most of the exports, causing orders to be switched to local mills.

Coupled with the revival of Wisconsin's lagging pulp industry is the demand of the railroads for a 10 per cent increase in freight rates on pulpwood. The Wisconsin pulp and Paper Manufacturers Association has opposed the increase, because Scandinavian and Canadian imports were driving Wisconsin pulp out of the market. Philip H. Porter, transportation director of the Wisconsin Public Service Commission, has recommended that the increase be limited to five per cent.

Work on Marathons $175,000 Building Progresses

Most of the concrete superstructure has been completed for the $175,000 office building and waxing department of the Menasha Products division of the Marathon Paper Mills Company at Menasha, Wis. Brickwork has been started on the three-story office unit, which will be pushed to completion rapidly.

No Lost-Time Accidents in Thilmany Mills

There were no lost-time accidents in the upper and lower mills of the Thilmany Pulp and Paper Company, Kaukauna, Wis., during November, according to L. C. Smith, personnel director. The upper mill has had a no-accident record for 79 consecutive days, and the upper mills 131 days. Stansbury Young and Albert Senso won prizes in the November safety contest.

Weidner-Lulloff Nuptials

Dr. Joyn Prestin Weidner and Miss Marjorie Lulloff, both of Green Bay, Wis., were married Saturday, December 2, at the Church of the Annunciation in Green Bay. They will reside, after a honeymoon trip, at Grace Manor Apartments at Green Bay. Dr. Weidner is a graduate of the Institute of Paper Chemistry and is a research chemist at the Hoberg Paper Mills, Inc., Green Bay.

Ontario to Permit Exports of Pulpwood

Minister of Lands and Forests States Government Will Continue Policy of Permitting Exports of Pulpwood From Crown Lands — Mill Town of Espanola May Become Resort—Queen City Paper Co. To Build Mill.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., December 11, 1939—A deputation of timber operators and civic officials from Northern Ontario waited upon Hon. Peter Heenan, Minister of Lands and Forests, during the past week in Toronto and were informed that the provincial government would continue its policy of permitting the export of pulpwood from Crown timber lands. Hon. C. W. Cox, Mayor of Port Arthur, who is a member of the Legislature, back in 1935 was, it was stated, largely responsible for securing export privileges but lately has set forth that he favors an embargo. In a brief presented to Hon. Mr. Heenan, the deputation charged that Hon. Mr. Cox was far from representing the wishes of the people in this connection and was proceeding in a manner "contrary to the best interests of the district." Mr. Heenan said that he was pleased to find that the delegation has not gone back on its representations made four years ago. He added there was no inclination on the part of the Ontario government to make any change in policy unless the people at the Great Lakes sent a responsible representation showing that the present policy is a detriment to the province. Mr. Heenan said that the deputation had convinced him that it was to the best interests of the timber industry and the province as a whole to continue the export of pulpwood from Crown lands. He asserted that in recent weeks Mr. Cox had declared that the policy of an embargo was no longer advisable and that an embargo on exports would force United States companies to locate in Ontario bringing new industries to the province, and that it would permit the utilization of more wood by Ontario mills. Mr. Cox had also charged that the export business was depleting the forest wealth of Ontario.

Price $50 Per Ton Newsprint in 1940

The price of fifty dollars a ton for newsprint announced by several producers as effective till the end of the first quarter of 1940 will be continued throughout the second quarter of next year by several operators. Commenting on the notice by the International Paper Company that the current price would be continued through the first half of 1940, G. T. Clarkson, Toronto, receiver and manager of the Abitibi Power and Paper Company, said that his concern had already decided to leave the price unchanged at fifty dollars in the second quarter of the coming year. He added that the various companies were acting independently and there might be higher prices quoted in some circles.

Queen City Paper Co. Erecting New Mill

It is understood that the Queen City Paper and Twine Company, Limited, Toronto, are erecting a mill for the manufacture of board and paper and that construction has started. The building will be completed early in the new year and production start about April next.

Douglas Morrison has been appointed representative in Ontario for the Fraser Companies, Edmundston, New Brunswick. An office has been opened at 330 Bay St., Toronto. The Toronto office of J. R. Booth, Limited, Ottawa, has been moved to 159 Bay St. and is in charge of Norman Bennett.

May Turn Mill Town into Tourist Resort

Located in the Spanish river district forty miles west of Sudbury, Ont., Espanola grew up around the newsprint mill established there by the Abitibi Power and Paper Company, now in receivership. The mill has not operated for ten years and some of the equipment has been moved to other mills conducted by the Abitibi Company. There is little or no prospect of Espanola ever becoming active again as a newsprint centre. There are some three hundred houses most of which are not in use, electric light, a large hotel and good motor roads. There is now a proposal to turn the "company town" into a tourist resort. It is said that if the Abitibi Company will undertake to carry out the project it will receive the cooperation of the whole district but the chief problem will be to find the capital and initiative to start such an enterprise.

An addition is being built to the wood room of the Canadian International Paper Company at Hawkesbury, Ont. The work is being done by the staff of the company. The Pulp Recovery Company are also contemplating building in Hawkesbury in the spring. John B. Woods will be in charge of the undertaking.

Rush of Wholesale Paper Orders Subsides

The wholesale paper business except for a few seasonable lines has slowed down considerably. The great rush of orders which set in after the declaration of war has slackened appreciably and the mills are beginning to catch up on some of the business which was placed. Since prices were withdrawn and all orders filled at the figures prevailing at the time of delivery, there have been expectations that higher prices will go into effect at the end of the year. It is believed owing to higher cost for all raw materials, there will be a sharp advance in all lines of book and writing as well as coated.

4,000 Men Worked in Bush Last Month

In the Algoma district of Ontario over four thousand bush men were engaged during the past month or about one fifth more than in October, according to Crown Timber Agent D. Smith. The Ontario Paper Company, Thorold, Ont., is the biggest employer in that area with seventeen hundred men cutting pulpwood. The Abitibi Power and Paper Company has a thousand men in the bush and J. J. McFadden, Limited, Blind River, has over seven hundred men. The labor situation is quiet just now as help is abundant. Many men who were engaged in road work have turned their attention to woods activities.

Philadelphia Trade Plans Christmas Party

Elaborate Plans Being Made By Philadelphia Paper Trade Association For Christmas — Rittenhouse Association of Paper Salesmen Meet — Waste Paper Association Elect—Peter J. Schweitzer Installs Fourdrinier.

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 11, 1939—The Philadelphia Paper Trade Association is making elaborate plans for its annual Christmas Party, which will be held at 'noon on Monday, December 18, at the Down Town Club. Wm. B. Killhour, president, has arranged a program of Christmas songs and music.

The last meeting of the Philadelphia Paper and Cordage Association for 1939 will take place at the Arcadia on Friday, December 15 at 12:30 o'clock, at which time the results of the election of officers and directors for 1940 will be announced, followed by induction of officers.

On Friday, December 8th, E. K. Lay, chairman of the Entertainment Committee announced the receipt of payment for some 125 tickets for the Christmas Party to be held on December 19th at the Arcadia, when the Association is host to sixty kiddies, recruited from the ranks of the Salvation Army. While Chairman Lay expressed his delight at the number of reservations already received, his goal is set for four hundred, and in a letter sent out by F. M. Kurz of Whiting-Patterson Company, who is secretary of the Association, the cooperation of every member is asked to help Mr. Lay attain his goal.

Rittenhouse Association Hold Meeting

Eighty-eight members of the Rittenhouse Association of Paper Salesmen met a week ago in the main dining room of the Bullitt Building Restaurant for the celebration of their first Christmas Party. Twenty door prizes were awarded, and in addition each member received an individual favor. Song sheets were provided and the singing was led by Harry Fleming of Garrett-Buchanan Company, who it said has only Nelson Eddy for a competitor.

The guest speaker was Inspector Lieutenant Burns of the Philadelphia Metropolitan Police, who in his address outlined the police setup and procedure of this area.

William B. Killhour, Jr., president of the Paper Trade Association of Philadelphia, spoke on the subject of the cooperation the Rittenhouse Association can expect in the forthcoming year from all the paper merchant houses.

President Robinson expressed his extreme satisfaction for the splendid turnout, and announced that the guest speaker at the meeting on January 5, 1940, would be the outstanding authority on press room troubles, Summerfield Eney of the Champion Coated Paper Company.

Waste Paper Association Elect Officers

The Waste Paper Merchants Association held its annual meeting at Broadwood Hotel on Tuesday of last week, at which time the nominating committee announced the re-election of all the officers for 1940, namely: Harry M. Bailey, president; Arthur L. Feierman, vice-president; William L. Simmons, treasurer, and Dominic DiSanti, secretary. Those appointed to the Executive Committee are: John Beitzhman, George A. DiIenno, Wm. J. McGarrity, Jr., Louis Bantigoglio, Peter DiBiaso, Morris Mossman and Edward Corner.

The date of the annual banquet will be announced in the very near future.

Schweitzer Installs Paper Machine

Details of the expansion program of Peter J. Schweitzer, Inc., manufacturers of cigarette papers, carbon and condenser papers, specialties, and "Strato" airmail bond, which have just been announced, include a 125-inch straight Fourdrinier machine, the order for which was placed with the Black-Clawson Company. The new machine, equipped with Beloit dual horizontal presses and Downingtown suction rolls, when completed, will be installed at the Elizabeth, N. J. plant in March. The company is at present operating two machines at Elizabeth and two at the mill in New Jersey, all of which are Fourdriniers.

Dinner Given to Charles W. Boyce

A "farewell" dinner was given to Charles Boyce, Secretary of the American Paper and Pulp Association, in the Carpenter Suite at the Waldorf Astoria Hotel on December 12. The Hotel, particularly Oscar and Joe Hoenig, cooperated with his fellow-secretaries in giving "Charlie" a rousing "farewell."

Oliver Porter acted as toastmaster and called on many of those present, particularly the "old-timers" in the secretarial field in the pulp and paper industry, all of whom responded warmly in wishing Mr. Boyce the very best of luck and prosperity in his new job with the Northwest Paper Company.

Robert Canfield was selected to present Mr. Boyce with the combination radio and phonograph which those who attended had purchased as a farewell gift. Mr. Canfield had the bright idea of making a record which, on one side, "spoke" a little presentation speech and on the other side gave a general reminder of many "do you remembers?" which Mr. Boyce can play for many years to come and which will remind him of many episodes which occurred during his career as a trade association secretary.

Mr. Boyce responded in his own inimitable manner and thanked everyone sincerely for the kindness and cooperation he had received from all durig his incumbency.

Those who attended the testimonial dinner were: T. G. Aspinwall, J. J. Bader, C. L. Barnum, C. W. Boyce, H. E. Brinckerhoff, W. B. Bullock, T. J. Burke, R. E. Canfield, W. W. Corlett, M. C. Dobrow, R. Fife, Col. B. A. Franklin, S. M. Hudson, G. Johnson, R. S. Kellogg, W. H. Kenety, F. C. Lowthrop, R. G. Macdonald, E. O. Merchant, F. Pocta, O. M. Porter, J. L. Ritchie, A. E. Sawyer, B. D. Wise.

Financial News of Pulp and Paper Industry

Kimberly-Clark, Flintkote and Champion Declare Dividends — Continental Reports Increased Profit — Dryden Earns $168,593 — Certain-Teed Stockholders Approve Dahlberg Agreement — A. P. W. Stock Issue.

New York Stock Exchange

High, Low and Last for the Week Ending December 13, 1939

	High	Low	Last
A. P. W.	2½	2½	2½
Armstrong Cork Co.	39⅞	37½	38
Celotex Corp.	11⅛	10⅜	10⅞
Celotex Corp., pf.	62½	60¾	62½
Certain-Teed Products Corp.	7⅛	6⅜	6⅝
Certain-Teed Products Corp., pf.	33½	29⅝	31½
Champion Paper & Fibre Co.	24¾	24	24½
Champion Paper & Fibre Co., pf.	105	104	104
Congoleum-Nairn Co.	23⅞	22¾	23
Container Corp. of America	17¼	16⅛	16½
Continental-Diamond Fibre Co.	7½	6⅞	7⅛
Crown-Zellerbach Co.	17⅜	16⅜	17⅜
Crown-Zellerbach Co., pf.	94	88¾	93
Flintkote Co.	22⅛	20¼	21
Robert Gair	4⅛	3⅜	3⅝
Robert Gair, pf.	16¾	16	16
International Paper & Power	13⅝	12⅞	13½
International Paper & Power, pf.	51⅞	48¼	51
Johns-Manville Corp.	79	74¼	75⅝
Johns-Manville Corp., pf.	130	130	130
Kimberly Clark Corp.	34½	34⅛	34⅛
MacAndrews & Forbes	31¼	30⅜	31
MacAndrews & Forbes, pf.	134½	134½	134¼
Masonite Corp.	38½	36¾	37¾
Mead Corp.	11¼	11	11⅛
Mead Corp., pf.	62	62	62
Paraffine Companies, Inc.	42	42	42
Rayonier, Inc.	16⅞	16	16⅞
Rayonier, Inc., pf.	28¾	26¾	28¾
Ruberoid Co.	19⅞	18¾	18¾
Scott Paper Co.	46¾	45⅞	46⅛
Scott Paper Co., pf.	114	112	112¼
Sutherland Paper Co.	28	27½	27¾
Union Bag & Paper Corp.	12¼	11⅜	12¼
United Paperboard Co.	5⅞	5	5½
U. S. Gypsum Co.	84½	81½	84½
U. S. Gypsum Co., pf.	172½	169	172½

New York Curb Exchange

High, Low and Last for the Week Ending December 13, 1939

	High	Low	Last
American Box Board Co.	8½	8⅛	8⅛
Brown Co., pf.	29¼	26⅜	29¼
Great Northern Paper	40	40	40
St. Regis Paper Co.	3⅜	2⅞	3
St. Regis Paper Co., pf.	53¾	52	52½
Taggart Corp.	6⅜	5⅜	6

Kimberly-Clark Declares Dividend

Directors of the Kimberly-Clark Corporation have authorized an extra dividend of 25 cents a share on the common stock, payable on December 27 to holders of record of December 12. With this extra dividend, but excluding the regular quarterly dividend of 25 cents previously declared payable on January 2, 1940, dividends for this year total $1.75 a share, an increase of 75 cents over the amount that the common stock received last year.

Continental Earns $22,607

Continental-Diamond Fibre Company for the quarter ended September 30, report a profit of $22,607 after taxes and charges, equal to 5 cents a share on 450,000 shares of common stock, compared with a loss of $166,794 in the September quarter a year ago and a profit of $9,580, or 2 cents a share in the June quarter this year. Nine months ended September 30, profit $49,496, or 11 cents a share, against a loss of $603,920 in the first nine months of last year.

Flintkote Votes $1 Dividend

A dividend of $1 a share was voted by the Flintkote Company, the first since 60 cents was distributed on December 20, 1938.

Dryden Earns $168,593

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 11, 1939—The annual report of the Dryden Paper Company Limited for the year ended September 30, 1939, shows operating profit at $168,593, as compared with $200,064 in the preceding year. Net profit was $97,251, against $98,396. F. A. Labbaton, president, in this report, said that prior to the outbreak of war the demand and price of kraft pulp were at the very lowest point, but since September 1st the demand for wrapping paper and the company's other products was near the plant's capacity, while at the same time the market price for surplus kraft pulp had materially increased. He said since the financial reorganization of the company in 1929 it had encountered a series of depressed business conditions. Nevertheless during this ten-year period it had been able to make sufficient profit to meet its bond interest, pay sinking fund (now amounting to something over $200,000) and to write off a reasonably large percentage of what should be a regular depreciation charge on its properties. He considered that with a continuation of better sales conditions the ultimate success of the company should be assured.

Dahlberg Contract Approved

At a special stockholders meeting of Certain-Teed Products Corporation holders of 94 7-10 per cent of common stock represented at the meeting approved the stock option granted to Bror G. Dahlberg, chairman, under the employment agreement dated May 13, 1939, entered into between Mr. Dahlberg and the corporation.

Under the terms of the agreement Mr. Dahlberg is given the right to buy at $12 per share an aggregate of 25,000 shares of Certain-Teed common stock over the period May 5, 1939, to November 4, 1944.

Of the 625,340 common shares outstanding 328,599 were represented at the meeting either by person or proxy.

A.P.W. Stock Issue

Through an error in transposition the heading of the item on page 47 of the November 30 issue of the PAPER TRADE JOURNAL was made to read, "A.W.P. stock issue ready," when it should have been, "A.P. W. stock issue ready," as the item refers to the A.P. W. Paper Company, Inc., and not to the American Writing Paper Corporation.

Champion Votes Dividend

The Champion Paper and Fibre Company ordered a 10-cent dividend to holders of the common stock. This is the first dividend on the issue since February 15, 1938, when 25 cents was paid.

New Ideas on the Use of Salt Cake In Kraft Pulp Mills*

By Walter L. Savell[1]

The writer wishes to make it clear at the outset that the present article is intended to be more of a preliminary review of possibilities than it is a completed technical report. The field has not yet been sufficiently covered to do more than point out what appear to be some opportunities for improvement in the chemical end of the kraft pulp process. Nor is this intended to suggest that all of the splendid work which has been done in the past is being overlooked or disregarded. It requires only a brief preview of the literature to uncover many excellent reports on the technical phases of the recovery process.

It is not unnatural to assume that the present interest in this subject has developed because of the disturbed international situation and the interruption of the supply of salt cake formerly imported from abroad. It happens, however, that the interest in the present line of research was developed in 1931.

It was in that year that Bray, Martin and Carpenter, in Technical Association Papers, reported improved strength and bleaching qualities of soda pulp digested with the soda-liquor to which sulphur had been added. This, of course, did not introduce the kraft pulp process by any means, since, according to the association's books on the manufacture of pulp and paper, Volume 3, we are informed that according to B. Hagglund the kraft process is the result of some experimental work done by C. F. Dahl. This work was done in Danzig and salt cake was used as a source of alkali, being cheaper than the soda ash available at that time, which was the year 1879. We all know that the pulp produced was not a soda pulp, but a new pulp which, because of its strength, was called kraft from the German and Swedish words of that meaning.

At the time Dahl carried out his work, salt cake was available in large quantities, a by-product of the production of muriatic acid and at that time still an intermediate product in the production of soda ash by the Le Blanc process. It is interesting to note the close association at that early date of salt cake production with the alkali industry. The derivation of the name is simple enough. In the production of muriatic acid, sulphuric acid was allowed to run into pans containing common salt. The reaction of the sulphuric acid with the salt naturally gave rise to the formation of hydrochloric acid gas which was rapidly evolved and combined with water to make a commercial solution. In the pan there remained a cake composed of anhydrous sodium sulphate with more or less excess sulphuric acid.

While the Le Blanc process is no longer operated commercially, there is still a certain amount of salt cake produced as a by-product in the manufacture of muriatic acid. The supplies available from this source, however, are not sufficient to take care of any more than a small fraction of the present demand. This is due to the comparatively limited consumption of muriatic acid.

Although various operations contribute to the supply of this valuable reagent going to the pulp industry and only a small portion of it is "salt cake" in the original sense of the term, it nevertheless all goes by this name since it serves the identical purpose as far as the pulp industry is concerned.

Economy of Alkali Pulping Processes

It is a matter of common knowledge that the alkaline pulping processes are economical to use only because it is possible to recover a major part of the pulping chemicals for re-use in a continuous cycle. In the early application of these processes it was soon discovered that one of the simplest ways of recovering the alkali from the organic matter with which it became associated in the digestion process, was to evaporate and dry the mixture of organic material and alkali to a point where the organic material charred. The alkali was then leached from the char and the solution recausticized; the char, of course, was used for fuel. From this we can see a natural evolution to the present methods in which the evaporation, charring, burning, and the formation of a molten mixture of recovered alkalies occurs in a modern high pressure boiler furnace.

Since Dahl's original observation, many scientists and technical workers have contributed data resulting from studies on the composition of the kraft cooking liquors. These liquors are known to contain two active ingredients. One is sodium sulphide and the other is sodium hydroxide (caustic soda). It is readily understood that sodium sulphate is not an ideal source of these materials, but under conditions which have prevailed at times past, it was the cheapest source if not the most convenient one.

The lack of convenience of the ordinary salt cake has been partly geographical and the present conditions make us acutely aware of this fault. Coming from abroad in major volume, the supply has been necessarily subject to the interruption occasioned by international disturbances such as are now in progress, the natural hazards of the long sea haul, the necessity for making purchases at periods greatly in advance of the actual time of use, and the large volumes required to make economical shipment possible.

On the chemical side, ordinary salt cake presents a certain phase of inconvenience because of its relatively unreactive nature. Referring now only to the behavior of sodium sulphate, we find that it reacts with carbon to form sodium sulphide according to the following reaction:

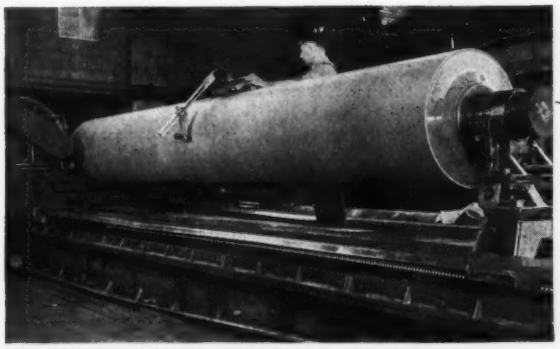
$$Na_2SO_4 + 4C \rightarrow Na_2S + 400$$

This reduction requires a considerable amount of heat at a high temperature at which point the sodium sulphide itself is partially volatile, especially under the conditions which prevail in the standard unit which requires the flow of large volumes of air to burn the excess or organic matter present. In the

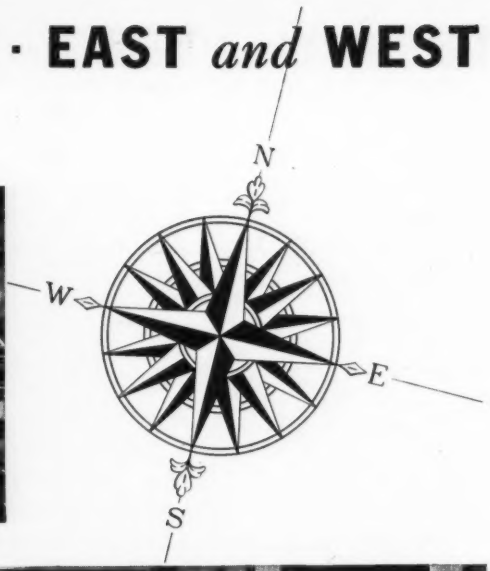
* Presented at the meeting of the Southern Div. of the American Pulp and Paper Mill Superintendents' Association at New Orleans, La.

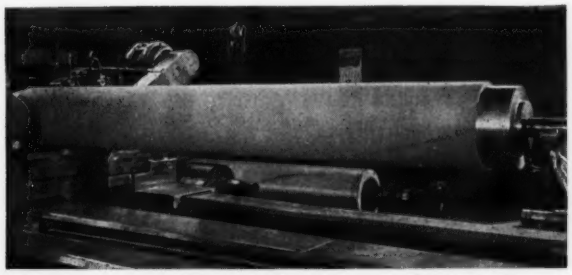
[1] Manager, Technical Service Div., The Mathieson Alkali Works (Inc.)

Serving NORTH · SOUTH · EAST *and* WEST

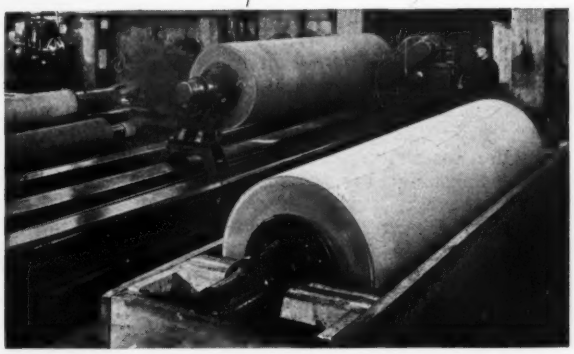


STONITE Top Press Roll, 227″ x 30″, shipped to Florida.



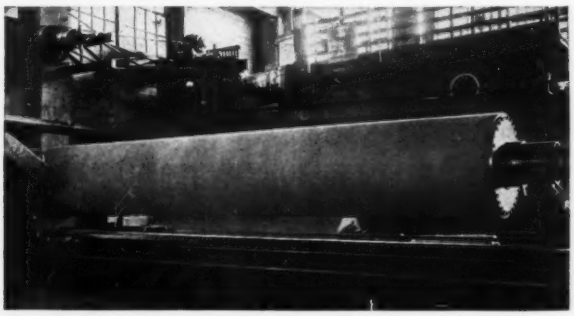


World's largest Waxing Roll, with specially designed body for uniform heat penetration and expansion, shipped to the Northwest.



Two of three Bottom Press Rolls shipped to the Pacific Coast. These rolls weigh over fifteen tons each.

Three 238″ FEATHERLITE Lumpbreaker rolls shipped abroad. This is a repeat order earned by excellent performance of initial installation.



Suction Press Roll, 36″ x 243″, shipped to the Southeast. Many mills always specify Stowe-Woodward covers when ordering suction press rolls from their machine builders.

STOWE-WOODWARD, INC. NEWTON UPPER FALLS · MASS.

NEW YORK OFFICE · WOOLWORTH BLDG.

Stowe-Woodward Rolls are made on the West Coast by HUNTINGTON RUBBER MILLS, INC., Seattle, Washington

Makers of **WHITE STAR** *Rubber Covered Rolls,* **TANNITE** *Couch Rolls*
STONITE *Top Press and Smoothing Rolls—All by the* **COREWELD** *Process*

beginning it was natural to borrow terms, methods, and equipment from the parent soda pulp process insofar as possible. It was necessary to replace the leaching equipment of the soda process with the smelter. This was necessary as just indicated in order to provide the high temperature and reducing conditions required to convert salt cake to active alkaline compounds.

Remarkable progress has been made in the design and construction of modern recovery furnaces and the boilers which they heat. It is apparent, however, that even with the improved efficiencies of the most modern unit the greatest single source of chemical loss is from the furnace and through the stack to the air.

In the year 1926 Rudolf Sieber reported in *Papier Fabrikant* that the loss of alkali from the kraft pulp process was equivalent to 5-10 kilograms of sodium sulphate per ton of pulp. We can commend his modesty if not his accuracy. Even the movement of a decimal point hardly brings the figures within a reasonable range of accuracy. It is probably fairer to say that the loss of alkali in the pulp digestion and chemical recovery cycle will probably range from 200 to 400 pounds of salt cake per ton of pulp produced. In other words, the replacement of active chemical lost in various ways requires the addition of sodium sulphate into the recovery furnace in amounts running from 200 to 400 pounds per ton of pulp produced.

Various analyses have been made for the purpose of determining the proportion of loss to be charged to the several steps in the process through which the cooking chemicals must pass to complete this cycle. One report in a Swedish journal published in 1929 gives the following figures. The figures given originally in per cent of the weight of pulp have been translated in terms of pounds of salt cake per ton of pulp.

	Pounds Na_2SO_4 lost
Pulp Washing	63.0
Lime Washing	64.4
Furnace	80.0
Handling	5.0
Total	212.4

American practice will give figures somewhat similar, using the so-called Swedish system of recovery. This includes the rotary and disc evaporations. The figures are about as follows for one plant.

	Pounds Na_2SO_4 lost
Pulp Washing	88
Caustic Room	15
Leakage	20
Blowing	12
Furnace	65
Total	200

From the information given to me from sources considered most reliable, I believe these figures represent excellent operation.

The spray type furnace such as the Tomlinson and others when used as a complete recovery unit do not show as high efficiency in chemical recovery as the older type recovery units altho they are greatly superior in steam production, materials, handling and many other respects.

A recent analysis of losses in a mill near the Atlantic seaboard shows the following figures with a modern furnace unit:

Washing	75 pounds
Caustic Room	15 pounds
Leakage	12 pounds
Blowing	12 pounds
Furnace	201 pounds
Total	315 pounds

While these figures are undoubtedly correct for this plant, they are not intended to be interpreted as the best possible conditions to be obtained with the spray type furnace. The discrepancy is sufficiently great, however, to raise a question.

Chemical Balance:

The question which naturally comes to mind concerns the history of the active chemicals in the two systems and reasons, if any exist, that would account for the difference in losses which can be ascribed to the furnace.

Assume for a moment that the chips are cooked with a solution containing 700 pounds of active alkali of which 30 per cent is sodium sulphide. This solution goes on its way and eventually reaches the furnace for burning and smelting. It is found that the losses experienced to that point and those anticipated require the addition of 315 pounds of salt cake with the concentrated black liquor carrying what remains of the original 700 pounds of mixed caustic soda and sodium sulphide. Disregarding further losses for the moment, we find that 315 pounds of salt cake should produce 173 pounds of sodium sulphide. Therefore, 700 minus 173 or 527 pounds should indicate the amount of active chemical equivalent returned in the black liquor. It is mentioned as active chemical equivalent since it is recognized that the form has been changed and the actual sodium and sulphur compounds present in the black liquor are not known with any degree of exactness. It is fair to assume and in fact is known that within reasonable limits the sodium and sulphur are in the same approximate ratio as in the original cooking liquid. Therefore, the equivalents should on recovery represent 30 per cent sodium sulphide in the chemicals recovered from the black liquor or $30 \times 527 = 158.10$. This amount of sodium sulphide added to the 173 pounds recovered from the fresh salt cake would total 331 pounds of sodium sulphide or in the re-inforced recovered active alkali it would represent a sulphidity of $\frac{331}{700} = 47.7$ per cent sulphidity as actual sodium sulphide. The amount of sulphidity added in the form of salt cake represents $\frac{173}{700} =$ 24.7 per cent sodium sulphide.

These figures merely demonstrate roughly what we know to be a fact—namely, that the loss of sulphur in the recovery process is greater than the loss of alkali. If it were not so, the sulphidity of the white liquor would increase rapidly unless alkali was added in some other form to maintain the desired condition. We know, however, that no such sulphidity increase is generally experienced and we know there is often a battle to maintain a definite predetermined sulphidity. This is often true if the desired sulphidity is relatively high—30 per cent or higher.

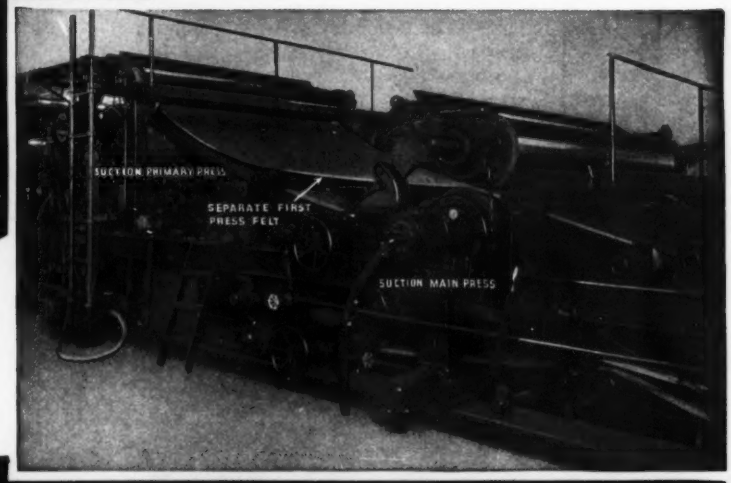
Any investigation of this subject soon reveals the fact that regardless of the availability and condition of the returned black liquor, it is impossible to recover a smelt from it alone which will maintain the sulphidity of the original cooking liquor. Evidence is readily available to indicate that the sulphur content of the returned black liquor is present mostly in the form of complex (all unfamiliar compounds are complex) organic compounds.

A series of experiments conducted to determine the behavior of this returned sulphur disclosed some very

Suctionize

YOUR BOARD MACHINE WITH Beloit SUCTION

DRUM PRESS *
PRIMARY PRESS
MAIN PRESS



Note the short top felt for suction drum press nip. All plain primaries have been removed.

Wet pickup felt returns after suction primary press. Suction first press is on separate felt.

1. Removes large quantity water without disturbing formation or finish.
2. Reduces crushing and checking.
3. Improves finish. Reduces felt marks.
4. Permits use of light weight short top felt. Lower felt cost.
5. Eliminates several nips. Improves test of board.
6. Permits more bulk if desired.
7. Increases test or permits cheaper furnish and maintain same test.
8. Suction main press more efficient on separate felt.

* Suction drum press is equivalent to suction drum and suction primary press.

BELOIT IRON WORKS PAPER MACH'Y BELOIT WIS.

THE BELOIT WAY IS THE MODERN WAY

BELOIT IRON WORKS, BELOIT, WIS.

interesting facts. Using a sample of 500 grams of black liquors running between 52 per cent and 70 per cent solid and gradually heating the samples in iron retorts, the distillates and gases were collected. The temperature of the samples was slowly increased to allow the water to distill off and then slowly raised to about 300 deg. C. This treatment represents the conditions applied to the black liquor in the recovery furnace during the drying process and raising the temperature to the point of ignition.

Analysis of the collected distillates shows that a major part of the sulphur originally present in the black liquor is evolved, during the drying and carbonizing, in the form of hydrogen sulphide. From this we can readily see why the smelt from black liquor alone will be poor in sulphides. Evolved as hydrogen sulphide during the early stage of heating, it passes into the secondary section of the furnace where it burns to sulphur dioxide and water passing out the flues and up the stack.

These results also show that the loss cannot be prevented by any method of operating the recovery furnace. In other words, it readily explains the reason sulphidity does not build up and why it is sometimes difficult to maintain a desired sulphidity—especially in a system that has low soda loss.

Out of these facts it is possible to draw certain conclusions. The older type recovery system, including rotary drier and disc evaporator, has certain definite advantages due to the scrubbing effect of the rotary and the disc evaporators. Material carried over from the furnace is trapped and returned to the furnace. Sulphur dioxide is also absorbed in such a system from the contact of the flue gases with the drying and evaporating black liquor. These conditions account in large measure for the better chemical efficiency which these old units show. We must also conclude that no recovery system can be operated to the best advantage if it does not include a scrubbing system following the furnace. No furnace or method of operating will permit good recovery of values now present in the stack gases.

These values are in three distinct forms:

1—Solids carried out mechanically
2—Solids in the form of fume
3—Sulphur dioxide resulting from the oxidation of hydrogen sulphide.

The solids carried out mechanically in most spray type furnaces represent an important proportion of the loss. The necessity for constant lancing of superheater and boiler tubes is sufficient evidence of this loss. Solids in the form of fume are only partly recoverable by a scrubbing system. However, actual fume losses appear to be relatively small and for present purposes will be disregarded. (They can be recovered by electrical precipitation, however).

The recovery of sulphur dioxide from stack gases is more important than is generally recognized. Efficient recovery of this compound makes possible improvements not possible in any other way.

1—A direct saving of chemical value otherwise lost.
2—A direct saving in chemical replacement.

With high sulphur recovery from stack gases returned as sulphates in the black liquor, the quantity of salt cake required is lowered and alkali in the form of soda ash may be used for chemical makeup. The latter may be added to the green liquor and furnace losses avoided. Generally speaking, one pound of soda ash added to the green liquor is equivalent in sodium oxide value to two pounds of salt cake added to the furnace.

3—Sulphur dioxide is a gas and after formation in the furnace from the oxidation of hydrogen sulphide, part of it combines with alkali to form sodium sulphite. This compound may usually be detected in the solid salts found in the economizer, superheater and boiler tubes. A part of it is carried out the stack either as free sulphur dioxide or as sodium sulphite. Soluble in any alkaline solution, it may be scrubbed from the stack gases with water or dilute black liquor and to a considerable degree may be removed and returned to the furnace by concentrated black liquor. Efficient removal from the stack gases make it possible to treat the stack gases economically for odor control.

In some localities the question of odor control is already important; in others it is likely to become so. It is most interesting to realize that chemical economy and odor control are interdependent.

Synthetic salt cake is expected to play an important part in the kraft pulp industry in the South. It is a manufactured product based upon a standard alkali and sulphur sintered together in proportions to make the chemical equivalent of salt cake in sodium oxide and sulphur content. The composition and method of production make it a particularly reactive material readily reduced to sodium sulphide.

Upon heating in the presence of a limited amount of air, reaction occurs with the components forming various sulphates and sodium sulphide directly. Since this reaction is exothermic the total heat required to form sodium sulphide is measurably less than is the case with sodium sulphate.

Synthetic salt cake is best introduced into the recovery furnace in the dry form and not in the black liquor. If introduced in the black liquor reaction with the organic components results in low sulphide content in the smelt with correspondingly high stack losses. Introduced separately in the reducing zone of the furnace preliminary formation of sulphide, sulphites and sulphate occurs and these compounds are then reduced in contact with the black ash.

Substantially, the reaction may be considered as—

$$Na_2CO_3 + S + 2C \rightarrow Na_2S + 3CO$$

Certain other possibilities of this versatile synthetic salt cake are not yet completely explored. We know it is possible to generate hydrogen sulphide directly from the new product and it may be possible to carry out the reaction absorbing the hydrogen sulphide directly in the white liquor without using the high temperature of the furnace for this reduction.

Now in commercial production, synthetic salt cake is available to the kraft pulp manufacturer at points in the Gulf area.

Canadian Pulp and Paper Directory

The 1940 edition of the National Directory of the Canadian Pulp and Paper Industries, published by the National Business Publications, Limited, Gardenvale, Que., Canada, has just been issued.

This standard and useful reference book of the Canadian industry was founded in 1907. The current edition contains the latest available statistics of the pulp and paper industries and its divisions and considerable important information on the manufacturers and distributors of pulp, paper and paper board, and on the converters of these materials into many varied products.

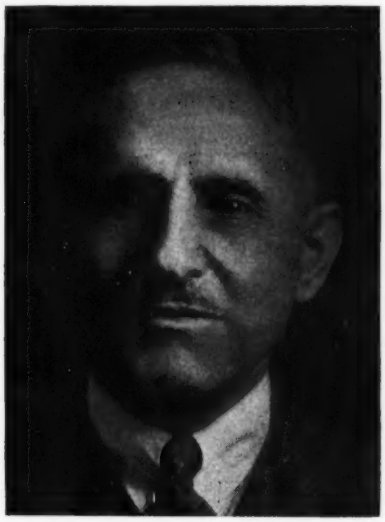
A number of important changes in personnel appears in this new edition and an improvement in the arrangement of listing manufacturers has been made.

Obituary

J. P. Heilbronn

Joseph P. Heilbronn of Manila, Philippine Islands and president of J. P. Heilbronn Company, of Manila, with New York office at 16 Beaver street, died early December 4 at Dante Hospital, San Francisco after an illness of six months.

Mr. Heilbronn was a member of the First California Volunteers who left San Francisco in May, 1898, captured Guam, arrived in the Philippines on June 30, and took part in the occupation of Manila on August 13th; he fought through the Philippine Insurrection and returned to be mustered out with his regiment in September 1899. He went back to the Philippines to engage in the paper business, establishing the firm which bears his name in 1909. He was a pioneer in every sense of the word, took an active part in the life of Manila, and is also widely known in the United States. He was born in Wiesbaden March 13th, 1868 and came to New York as a youth, arriving in San Francisco in 1891 where he was employed by Blake, Moffitt and Towne until his removal to Manila.



J. P. HEILBRONN

He was a member of the Elks and Rotary Clubs of Manila, of Islam Temple and the Olympic Club in San Francisco, of Far East Commandery K. T. and the Scottish Rite Bodies and of the Army and Navy Club in Manila. He was Past Commander of Stotsenburg Camp and Past Department Commander of the United Spanish War Veterans of the Philippines.

He is survived by his widow, Charlotte Ellen Klopp, formerly of Brooklyn, N. Y.

Funeral services were held at the Halsted Mortuary, upon the arrival of the S.S. "Pres. Coolidge" from Manila, bringing Mr. John R. Carmichael, an officer of the J. P. Heilbronn Company.

William J. Herrmann

William J. Herrmann, 54, president of W. J. Herrmann, Inc., paper merchants, Milwaukee, Wis., died at his home on November 30.

"Billy", as he was known to his host of friends among both merchants and manufacturers, had been active in the fine paper business in Milwaukee for almost forty years. Born in 1885, he began work as an errand boy for the E. A. Bouer Company at the age of fifteen. Upon the death of Mr. Bouer in 1915 he became manager of that company and remained in that position until 1934 when he organized the company which bears his name.

Mr. Herrmann was a member of Kilbourn Lodge, F. and A.M.; Tripoli Temple; the Wisconsin Consistory; Kilbourn Council No. 9, R. and S. M.; Kilbourn Chapter, R. A. M., and Ivanhoe Commandery, Knights Templar. He was also active in civic organizations and a member of the Milwaukee Athletic Club.

For many years Mr. Herrmann was active in the National and Western Paper Trade Associations, serving on various committees. He was very active, also, in the work of the local Wisconsin Association.

Survivors are his widow, Clara; a daughter, Mrs. Ruth Fohey; a Grandson, Billy; a son-in-law, three brothers and four sisters.

J. W. Evans

J. W. Evans, president and treasurer of The Standard Paper Company, Cincinnati, O., one of the older paper distributing firms in that city, died last week in Cincinnati.

Mr. Evans had a large acquaintance and many friends among the paper merchants and mills in his locality and was one of the most constructive influences in the fine paper trade in The Central States Paper Trade Association.

Delaware TAPPI Discusses Size Testing

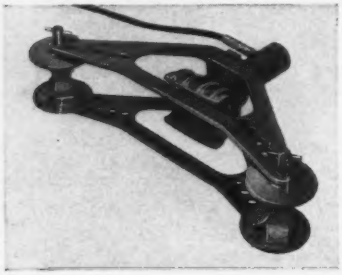
The Delaware Valley Section of the Technical Association of the Pulp and Paper Industry met at the Engineers Club, Philadelphia, Pa., Friday evening, December 8, 1939. C. M. Connor of the Valley Forge Laboratories presided as chairman. There were about sixty present.

H. F. Heller of the Hercules Powder Company discussed the development of the new Fluorescence Size Tester. This instrument which was developed by the Hercules Powder Company in a cooperative research project with the Institute of Paper Chemistry was recently described in the PAPER TRADE JOURNAL, November 23, 1939.

Among those present were: J. F. Labberty, E. J. Stokes, Edw. J. Albert, D. W. Garrow, Jr., J. S. Thompson, Walter W. Wolf, Harry Hulmes, Samuel Hagner, Lester Done, H. J. Farra, Sr., H. J. Farra, Jr., A. E. Waugh, S. G. Binscoe, Craig Maxwell, G. E. Lauctt, Walter B. Morehouse, G. L. Schwartz, J. F. Halladay, Ralph W. Kumler, C. M. Connor, J. D. Davis, J. R. Atwater, Fred Stoicher, C. E. Mueller, J. Edge, R. S. Stuart, Jr., R. H. Underdown, Paul Easton, C. W. Hoffman, L. F. Derr, H. F. Heller, C. E. Kinney, J. C. Dieffenderfer, J. M. Chesnutt, Robert de S. Couch, W. M. Shoemaker, V. Jacobsen, Wentcott C. Kenyon, A. L. M. Bixler, James H. Fritz, C. W. Rivise, Ward Harrison, C. R. Beeson, G. M. Suydam, James McCalmont, R. H. Dillinger, Thomas P. Field, Andrew S. Hall, P. M. Loddengaard, J. R. Hubbard, R. Tutt, Jr., E. N. Poor, Hirman Lied Berg, Alex. McInnes, Jr., M. D. Reuben, J. D. Gercke, John Macadam, Ray Robinson, Joseph Razek, and Adolf Hurabel.

Blackhawk Pipe Benders

A new Porto-Power hydraulic pipe bender has been recently announced by the Blackhawk Manufacturing Company, 5325 West Rogers avenue, Milwaukee, Wis. Possessing the merit of light weight, Porto-Power pipe and conduit benders are compact and portable.



Model S-36, weighing 243 pounds, handles seven sizes of rigid conduit and pipe in 1¼, 1½, 2, 2½, 3, 3½ and 4-inch diameters. The 20-ton Porto-Power hydraulic unit is quickly removed from the bending frame and used with special attachments for pulling gears and pulleys and for lifting over large spans at any angle and for many other uses about industrial plants.

The Porto-Power hydraulic unit is not an ordinary hydraulic jack, the pump being separated from the ram by a 6 feet length of high pressure hose, thus permitting the ram to operate in all directions, at any angle, and anywhere desired. All operations are controlled at the pump and the ram plunger retracts automatically when release valve on pump is operated. The ram is also useful as a regular jack for all directional action in close quarters.

Model S-30A, is a new lightweight unit, weighing 190 pounds. It is equipped with a simplified one-piece bending ram which the company states eliminates 13 various extension bars, tension arms, etc., formerly used. This model, equipped with a 10-ton Porto-Power hydraulic unit, is similar to the larger model but handles a popular pipe range of 1, 1¼, 1½ and 2-inch diameters.

Both models of new Blackhawk benders are packed in portable kits for carrying directly to the pipe bending job by rolling to the work.

Cargo of Clay Reaches Trenton

TRENTON, N. J., December 11, 1939—Carrying the largest cargo of its kind ever to be brought to this city, the S. S. "Emmy," of Greek registry, tied up at the Marine Terminal last week.

The cargo, consisting of 6,250 tons, is made up of Cornish China clay, as mined in Cornwall; Cornwall stone, mined in Cornwall, England, and Ball clay, mined in Devonshire and Dorsetshire, England. The load was brought here by various clay importers. Some of the cargo is for Trenton manufacturing concerns, while the balance will be shipped by rail to distant points.

Shippers point out that sufficient tonnage of these materials is being received to more than cover all normal requirements, and that within the past few weeks similar loads have been arriving at various other points along the Atlantic Coast.

The Emmy sailed from Fowey, England, November 11, in command of Captain Nicholas Vergottis. The jovial skipper was glad to reach port. He declared that the voyage was uneventful and satisfactory except for bad weather. Due to weather conditions he said that he had not been in bed for 22 days, "but will sleep well now."

The Emmy has not been in its home port, Cephalonia, for more than a year and one-half, according to Captain Vergottis.

Wood Pulp Crowds Port of Albany

[FROM OUR REGULAR CORRESPONDENT]

ALBANY, N. Y., December 9, 1939—Storage space here is reported at a premium at the Port of Albany after the most hectic rush in wood pulp cargoes from overseas in its history. Announcement, however, was made that there is enough room to handle cargoes moving directly from ships to railroad cars or trucks but the storage sections had space for only about one cargo. The port has been operating under an embargo for some time and the rush has been unusually large. It was indicated, however, some of the pulp laden vessels now at the docks may have to wait until the middle of the month when more space will be released under the free storage provision. It is estimated that the warehouses now contain about 30,000 tons of pulp wood with 20,000 tons additional to be unloaded from the ships. This is the first time that the port has had such a waiting list. The pulp wood rush is now regarded at an end for the season and the increase in tonnage was attributed to the efforts of importers to get their pulp consignments from Scandinavian countries through the war zones as rapidly as possible. There also has been a marked increase in the business of the paper concerns in this country.

Finnish Paper and Pulp Imports

The following statistics regarding imports of paper and pulp from Finland are especially interesting in view of the conditions in Europe, the figures given being expressed in tons:—

	October		First 10 Months		Year	Per cent of U. S. 1938 Consumption
	1939	1938	1939	1938	1938	
Bleached sulphite....	4,771	4,259	59,443	37,961	53,201	4.3
Unbleached sulphite.	13,293	16,142	95,133	92,223	117,167	9.1
Bleached sulphate...	669	38	5,926	2,088	2,617	0.6
Unbleached sulphate.	8,795	4,497	86,892	55,691	69,051	2.7
Newsprint paper....	19,414	12,250	172,566	119,675	151,134	4.4

L. A. De Guere, Consulting Engineer On Mill of Ohio Wax Paper Co.

In the article describing the new paper mill of the Ohio Wax Paper Company, Columbus, Ohio, in the Mill and Mill Equipment Number of the PAPER TRADE JOURNAL issued November 30, it was neglected to state that the consulting engineer was L. A. DeGuere, Wisconsin Rapids, Wis.

Construction News of Pulp and Paper Mills

Kimberly-Clark Plan Addition To Neenah Mill — Northwest Builds Recovery Unit At Cloquet — National Gypsum May Build Wall Board Plant At Toronto — Union Bag Corp. To Erect Evaporator Building.

Jackson, Miss.—The Great Southern Box Company, New Orleans, La., manufacturer of corrugated fiber boxes and containers, has selected property on Fannin road, East Jackson, as site for new branch plant, for which plans will be completed at once. It will be one-story, 70 x 250 feet. Cost estimated close to $150,000, including equipment. It is expected to begin work early in 1940.

Neenah, Wis.—The Kimberly-Clark Corporation, 128 North Commercial street, manufacturer of cover paper stocks, wall papers, etc., is reported planning new one-story addition to local mill, with work to be carried out early next year. No estimate of cost has been announced.

Cloquet, Minn.—The Northwest Paper Company, has begun excavations for proposed new addition to mill, recently referred to in these columns, to be two-story, 45 x 92 feet. It will be equipped as a recovery unit and is reported to cost over $60,000, with equipment, forming part of proposed expansion and improvements at mill, to total close to $100,000. Erection will be carried out by day labor.

Ampthill, Va.—E. I. du Pont de Nemours & Co., Inc., Rayon Division, du Pont Building, Wilmington, Del., manufacturer of cellulose rayon products, has authorized expansion and improvements in mill at Ampthill, including new production units, improvements in present equipment and other modernization. Considerable increase in present capacity will be carried out. Work is scheduled to be placed under way at once. Cost estimated close to $1,000,000, including machinery.

Buffalo, N. Y.—The National Gypsum Company, 190 Delaware avenue, Buffalo, manufacturer of wall board, insulating materials, etc., has negotiations under way for acquisition of property at Toronto, Ont., as site for proposed new plant, to consist of a main one-story unit and several auxiliary structures for production of wall board and allied products. This supplements recent announcement of investigations of company for a similar site at Montreal, Que., where another branch Canadian mill is projected for like character of production. It is understood that both developments are under consideration for 1940. Estimates of cost of new mills are being made. Company has work progressing on expansion and improvements in branch mill at East River and East 150th street, Bronx, New York, previously referred to in these columns, where a new plant unit is being installed for the production of wall board. Other mill units are being expanded for an increase of about 50 per cent capacity in present rating, to include installation of conveying and other mechanical-handling equipment in addition to general production machinery. A new mechanical dryer will be installed. Entire project will cost approximately $2,000,000 and is scheduled for completion next year.

Savannah, Ga.—The Union Bag and Paper Corporation, Woolworth Building, New York, N. Y., has approved plans for new addition to kraft paper mill at Savannah, consisting of a one-story unit, to be equipped as an evaporator building. Award for evaporator equipment has been made to the Swenson Evaporator Company, Harvey, Ill., consisting of six-body quintuple units with capacity of 200 tons. Expansion is estimated to cost close to $100,000, with machinery, and will be pushed to early completion.

Newark, N. J.—Kelly & Co., Inc., 215 Wilson avenue, waste paper and other paper mill supplies, has recently acquired property at 80 Delancey street, and will occupy for storage and distribution. Company is removing from first noted address to new building, where increased facilities will be provided.

Montreal, Que.—The Lawson Litho & Folding Box Company, Ltd., 6629 Esplanade avenue, manufacturer of folding and other paper boxes and containers, has superstructure in progress on new three-story and basement plant unit, and proposes to have the building ready for occupancy early in 1940. It will provide for considerable increased capacity. Cost is estimated in excess of $50,000, as previously noted in these columns. General erection contract is being carried out by H. C. Johnstone & Company, Ltd., 1502 Ste. Catherine street, West, Montreal.

Kraft Assessment Case Concluded

A single justice of the United States Customs Court Justice Kincheloe, appointed by the Appellate Division to decide a case covering duty assessment on imported kraft paper, has rendered a decision in favor of the plaintiff, the Arkell Safety Bag Company, New York, N. Y. The case has been before the Court, tried and re-tried several times, since 1930, in an effort on the part of importers of such material to secure duty assessment on the basis of foreign export value instead of foreign market value. The ruling of the single justice follows the findings of the Appellate Division, holding in favor of foreign export value and reversing a decision previously made sustaining the claim of the Government for foreign market value. In this, the Court found that a controlled home market in Sweden made export values applicable and remanded the case for a single justice to determine the proper unit prices, as noted. The decision of the latter covers the invoice prices, less non-dutiable figures, for a number of importations as covered by the proceedings. This sustains the contention of the plaintiffs. As attorneys for the Government have not appealed for a review of this decision, the ruling becomes final, concluding the extended case.

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COMING EVENTS IN PAPER INDUSTRY

NEW ENGLAND SECTION. Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Roger Smith Hotel, Holyoke, Mass.

DELAWARE VALLEY SECTION. Technical Association of the Pulp and Paper Industry—Second Friday of each month at the Engineers Club, Philadelphia, Pa.

LAKE STATES SECTION. Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

KALAMAZOO VALLEY SECTION. Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park, American Hotel, Kalamazoo, Mich.

GOVERNMENT ECONOMY NEEDED

When Congress meets in the coming session it faces the necessity of making a decision to either raise the debt limit or return to a more economical policy that may lead to a balanced budget within a few years. It seems plain enough to many business men that no tax system can be drawn up to continue the present high expenditures without putting a brake on business that would severely depress business activity and thus lower Federal income instead of raising it. Some New Dealers have expressed the opinion that it is only necessary to wait until the national income reached 90 billion dollars, when the budget will be automatically balanced. Other New Dealers are not so optimistic and many Democrats and Republican Congressmen believe that the taxation and spending policy of the Administration should be overhauled and a more economical procedure adopted.

Senator Burton K. Wheeler, progressive Democrat of Montana, in an address at the dinner of the Congress of American Industry, at the Waldorf-Astoria on December 8, declared he was in favor of balancing the budget, elimination of waste and extravagance in government expenditures, revision of the Wagner Act and other legislative action that would encourage the development of private enterprise to achieve prosperity. Assuring the 2,500 leaders of industry present at the final session of the congress, held under the auspices of the National Association of Manufacturers, Senator Wheeler said, "If prosperity results from cooperation by business, government and labor there would be more profits for business, more work and better wages for labor, more markets and better prices for the farmer and more security for the public."

Senator Wheeler told the manufacturers; "This nation of ours faces a grave crisis, perhaps the most threatening in our history. There is a common call, a sacred summons, and you and your associates, and I and my friends, regardless of our label or views, must respond. Foremost in our minds today is the European situation. The United States must keep out of it. Regardless of so-called scientific polls, I refuse to believe that even a small percentage of the American people think we should become involved in any foreign conflict. . . . I voted against repeal of the arms embargo, but I believe those who voted for repeal are equally determined that the United States remain at peace. . . . We must maintain our present sense of balance and our intelligence, regardless of any incident or series of incidents which might arouse our emotions, as in 1915 and 1916."

Although approving what he termed the progressive legislation adopted under the Roosevelt Administration, Senator Wheeler said, in discussing domestic problems; "Progressive legislation, carefully drafted, openly debated, and competently administered but strengthens democracy. Some recent legislation has been subjected to the most bitter denunciation. Divergent groups and industry have sharply criticized the National Labor Relations Act and its administration. Congress is now studying this and I have no doubt that corrective steps will be taken. Public opinion in a democracy, sooner or later, furnishes protection from bad laws and inefficient executives.

"The hour has come when we must stop, look and listen. We must reinforce our much-advanced position in the battle of economic and social reform. The effects of existing legislation and its operation are being carefully studied by the public much more carefully than the zealot contemplates. Every intelligent business man realized we must have reforms to meet changing conditions, but reforms must be constructive and not destructive. They should always be within the framework of free government. Business seeks the greatest possible degree of stability. Business plans for tomorrow must be projected today. Shifting economic philosophies reflected in legislative enactments make difficult, if not impossible, such planning by business. Statutes construed and manipulated by overzealous administrators create an uncertainty more feared by business than drastic, though specific legislation."

In discussing taxation, Senator Wheeler expressed the opinion that business men did not object to taxes necessary to produce revenue for "the legitimate activities of government or for the alleviation of human misery. But the American people and the American business man do object, and with great justification, to waste and extravagance of public funds by government officials. It should never be forgotten that financial bankruptcy is the first and most direct

step to political bankruptcy, to dictatorship. A dictator is but the receiver of a bankrupt nation. Let us, of course, realize that periods of national emergency, such as we have been experiencing, put the possibility of a balanced budget beyond the power of either a liberal or a conservative administration. Every thinking person realizes that every effort should be made to balance our national budget. The present Congress of the United States is aiming in that direction."

In speaking at the afternoon session of the congress, C. M. Chester, chairman of General Foods, Inc., said that American industry had succeeded in lifting employment above the 1929 peak. The survey recently completed by the National Association of Manufacturers, Mr. Chester said, showed that, "The November, 1939, employment in manufacturing industry is 2 per cent above the 1929 average, 3 per cent above November, 1929, and 14 per cent above November, 1938. As for the outlook for the next six months, 65 of the companies reporting believe that business during the next six months will be as good or better than at present, while 16 per cent thought it would be worse; 19 per cent expressed no opinion."

To Expand Lumbering Operations

Lumbering operations by Quebec's important pulp and paper companies are expected locally to be appreciably expanded during the current winter season, according to a report from Consul J. I. Touchette, Montreal, made public by the Department of Commerce.

One large company has already announced that it will increase its cut by about 60 per cent and employ approximately 4,000 men in its forest operations.

Canadian October newsprint output, of which over 50 per cent was produced in the Province of Quebec, were on a larger scale than for any month since the end of 1937. Production increased to 280,985 tons in October 1939, a gain of more than 10 per cent over October of last year.

Prior to the declaration of war in September, Canadian newsprint mills had been operating at about 65 per cent of capacity a figure which has now been raised to 77.5 per cent. As operating expenses have not greatly increased and as mills supplying the American market quote in American dollars today, gaining a premium of 10 per cent under the Canadian exchange control system, prospects in the local pulp industry are bright. It is reported that Quebec pulp manufacturers expect to fill orders totaling about 400,000 tons of paper and pulp which were formerly supplied by Scandinavian countries.

T. G. Pell Discusses Oxford Products

BOSTON, Mass., December 11, 1939—T. G. Pell, of the Oxford Paper Company, Rumford, Me., general and sales office in New York City, discussed products of his company at a sales meeting of Carter Rice & Co., Corporation, Saturday morning. Frank H. Winter, sales manager of the Carter Rice company, presided.

Production Ratio Report

The statistics are based upon paper production reports to the American Paper and Pulp Association:

COMPARATIVE MONTHLY SUMMARIES[1]

Months	1939	1938	1937	1936	1935	1934
January	77.5%	63.9%	90.3%	76.1%	65.8%	.....
February	81.7%	68.7%	90.1%	77.9%	70.0%	.....
March	84.0%	69.6%	90.3%	76.0%	70.5%	.....
April	82.9%	68.3%	92.1%	82.3%	70.0%	.....
May	80.2%	69.0%	90.6%	81.6%	69.4%	.....
June	79.7%	66.0%	87.3%	80.7%	72.3%	.....
July	75.2%	72.0%	81.8%	77.3%	64.9%	.....
August	82.9%	77.2%	82.9%	81.5%	70.9%	.....
September	88.7%	76.3%	78.6%	80.5%	71.9%	58.2%
October	96.6%	82.5%	73.5%	87.6%	75.6%	64.7%
November	97.3%	79.6%	61.9%	88.0%	75.3%	61.7%
December	.....	74.4%	54.5%	85.9%	71.2%	59.6%
Year Average	.....	72.3%	80.6%	81.3%	70.5%	.....
First 48 weeks	84.3%	72.2%	83.0%	81.1%	70.5%	.....

COMPARATIVE WEEKLY SUMMARIES[1]

CURRENT WEEKS, 1939		CORRESPONDING WEEKS, 1938	
October 28	97.8%	October 29	81.8%
November 4	98.1%	November 5	82.4%
November 11	98.1%	November 12	80.9%
November 18	98.4%	November 19	81.6%
November 25	97.2%	November 26	74.4%
December 2	92.5%	December 3	78.8%

The following statistics show the number of mills reporting by ratio groups:

	Number of Mills Reporting—Current Weeks					
Ratio Limits	Oct. 28, 1939	Nov. 4 1939	Nov. 11, 1939	Nov. 18, 1939	Nov. 25, 1939	Dec. 2, 1939
0% to 50%	35	31	31	28	36	30
51% to 100%	270	273	269	270	252	136
Total Mills Reporting	305	304	300	298	288	166

PAPERBOARD OPERATING RATIOS

Per cents of operation based on "Inch-Hours" reported to the National Paperboard Association:

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1935	62%	68%	68%	63%	61%	66%	62%
1936	62%	67%	67%	70%	69%	70%	69%
1937	80%	86%	86%	88%	85%	77%	66%
1938	54%	60%	61%	57%	58%	56%	57%
1939	60%	67%	71%	69%	64%	67%	63%

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1935	67%	71%	77%	71%	61%	66%
1936	75%	78%	82%	80%	74%	72%
1937	74%	69%	65%	55%	45%	73%
1938	66%	66%	70%	65%	59%	61%
1939	72%	74%	84%	....	....	....

Week end. Oct. 28, 1939—85%
Week end. Nov. 4, 1939—84%
Week end. Nov. 11, 1939—84%
Week end. Nov. 18, 1939—83%
Week end. Nov. 25, 1939—78%
Week end. Dec. 2, 1939—78%

[1] Production-capacity ratios are based upon six-day capacity ratings which are adjusted periodically to correspond with the ratings reported by individual companies. Ratios are subject to revision until all reports are received.

Air Conditions Finishing Room

The Hopper Paper Company of Taylorville, Ill. has recently completed the installation of a thoroughly air conditioned finishing room with controls which make it possible to duplicate any printing room condition between temperatures of 70 deg. Fahr. and 85 deg. Fahr. and relative humidities between 35 per cent and 65 per cent. Any specified condition, within the ranges stated, may be established within twenty minutes, and maintained within a variance of one degree of temperature and one per cent of relative humidity.

The mill can now sheet, inspect, trim and pack paper ready for shipment in atmospheric conditions exactly the same as those of the printing plant to which it is to be shipped.

The installation was designed by the Perfecting Service Corporation, Chicago, Ill., consulting engineers, and the equipment was furnished by the Carrier Corporation.

PERIENCE
EBG
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Section of the
Technical Association of the Pulp and Paper Industry

Edited by Ronald G. Macdonald, Secretary

Application of A Quantitative Technique to The Evaluation of Color Stability of Bleached Pulps. Influence of Machine Drying and Natural Aging Upon This Evaluation*

By James W. McIntyre[1]

Abstract

Using specially constructed equipment, a study was made of the effect of temperature and humidity upon the rate of discoloration of bleached sulphite pulp. Discoloration rates were determined by the method of Tongren using reflectivities as measured by 458 mmu. by the General Electric recording spectrophotometer. A minimum point in the rate of discoloration was found at about 20 per cent relative humidity at 85 and 95 deg. C., respectively. Other temperatures were not investigated thoroughly.

Extension of the humidity-rate of discoloration study at 95 deg. C. to include other types of pulp showed that the position of the minimum rate of discoloration was variable, a soda pulp showing no minimum rate down to 2.0 per cent relative humidity. As a result of this, the relative values of accelerated discoloration rates of various pulps are dependent upon the humidity of the aging atmosphere.

The theory was postulated that rates of discoloration determined at a humidity which would maintain a normal moisture content in the sheets at the aging temperature should parallel most closely the results of natural aging. Accordingly, 55.4 per cent relative humidity at 95 deg. C. was arbitrarily adopted as a standard aging condition. Under these conditions, a moisture content of about 5.7 per cent was maintained in the sheets during aging.

In a study of some of the variables of pulp handling prior to accelerated aging tests, it was found that heat-drying of bleached sulphite pulp prior to handsheet preparation caused a marked increase in subsequent color stability. The increase in color permanency is not due to the reduction in reflectance which occurs during the machine-drying of pulp. When dry sheets are heated, although they may undergo a loss in reflectance comparable to that occasioned by machine-drying, their rate of accelerated discoloration is unchanged. Thus it appears that in the presence of heat and moisture, some reaction occurs in sulphite pulp which, although reducing the reflectance somewhat, tends to stabilize this property to a marked extent.

In an evaluation of the effect of wet storage of pulp upon subsequent accelerated aging behavior, it was found that thirty days storage of a bleached sulphite pulp as wet laps reduced the accelerated discoloration rate of air-dried handsheets prepared therefrom to 73.0 per cent of the value of handsheets prepared from the freshly bleached pulp.

Dry storage of air-dried handsheets made from a slush pulp, although causing a marked reduction in reflectivity, caused no change in subsequent accelerated discoloration rate. A slight increase in aging rate, after similar storage, was observed for air-dried handsheets prepared from machine-dried pulp.

Natural aging studies carried out in the various pulps showed that the results of the accelerated tests at 95 deg. C. and 55.4 per cent relative humidity paralleled the rates of naturally occurring discoloration better than did the results of the accelerated tests at 2.0 per cent relative humidity. The relation of natural discoloration rate to accelerated discoloration rate as determined was not constant, since the natural aging rate was subject to greater percentage change by reason of prior pulp treatment than was the accelerated rate.

The color stabilities of the standard grades of bleached sulphite, soda, and sulphate pulps vary widely. This variation is significant since, for given standards of paper manufacture, the color permanency of the paper products will vary with the color permanency of the base pulps.

The absolute criterion of the permanency of a pulp or paper is its behavior under the conditions of natural aging. However, the time required for the evaluation of a product by this method is often

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, Syracuse, N. Y., September 12-14, 1939.
A portion of a thesis submitted in partial fulfillment of the requirements of The Institute of Paper Chemistry for the degree of Doctor of Philosophy from Lawrence College, June, 1938.
[1] Munising Paper Co., Munising, Mich.

impractical, and for this reason methods using light and heat to accelerate the deterioration have been developed. The relative degree to which the product withstands this treatment is taken as an indication of its probable resistance to natural aging.

A review of the literature shows that, except for the work of Tongren, the work done on the problem of color permanency of pulp has been reported in general, qualitative terms. Tongren *(1)* derived a numerical index of the rate of discoloration in the following manner: Samples of paper are aged at a given elevated temperature for definite periods, and at the end of each interval the reflectivity is determined on the General Electric reflection meter. The reflectivities are transformed to Kubelka and Munk numbers and, when these are plotted as ordinates against the square roots of the aging times as abscissae, a straight line results. The slope of the latter is a numerical index of the relative rate of discoloration of the sample.

From the conclusion of the bleaching operation, the color of pulp is undergoing continuous change. Therefore, before interpretation of a color stability evaluation with relation to fundamental pulp characteristics can be made, it is necessary to know how the changes brought about by the washing, lapping, drying, and storage of the bleached pulp affect the subsequent rate of deterioration.

The work reported here deals with the following questions: The development of a certain technique for accelerated color aging tests; the effect, within certain limits, of the accelerated aging variables of temperature and humidity of the aging atmosphere; the effect on color stability of certain variables in the handling of sulphite pulp subsequent to bleaching; the relation between the results of the accelerated aging tests and the behavior of the pulps under natural conditions of aging.

Equipment

The General Electric Recording Spectrophotometer. The General Electric recording spectrophotometer was used for measurement of reflectivity of the pulp samples. Michaelson and Liebhafsky *(2)* have described this instrument in detail.

The Schopper "Rapid Kothen" Sheet Machine. The Rapid Kothen sheet machine was used in sheet manufacture because it gives a fairly large sheet (8 in. in diam.) and is admirably adapted for recirculation of white water.

The apparatus consists essentially of a glass deckle box, wire, and drainage chamber, so connected with a reservoir and vacuum-water pump that water may be pumped from the reservoir to the deckle box, valves repositioned, and vacuum applied to the drainage chamber to form the sheet. The vacuum is broken, the sheet couched, and the water drained from the drainage chamber to the reservoir for reuse. Fresh water may be used if desired.

The Aging Oven. The oven used for the accelerated aging determinations is a type manufactured by the Freas Thermo Electric Company of Chicago, Illinois. The capacity of the oven is approximately 8.5 cu. ft. Rapid circulation of the heated air over the thermostat and heaters is insured by a blower whose estimated capacity is 100 cu. ft. per minute.

The temperature within the oven is indicated by a Cenco precision thermometer graduated in 0.1 deg. C. and totally immersed in the air stream. As measured by this thermometer, variation in temperature within the oven is ±0.1 deg. C. from a control point which may be regulated to within ±0.025 deg. of the desired temperature.

A 2-in. air inlet is located on the low-pressure side of the blower, and a similar air outlet is located on top of the oven, so that air of controlled moisture content can be introduced into the oven and recirculated through the auxiliary humidifying equipment.

The Humidifying Equipment. The moisture content of the air in the oven was controlled by means of humidifying equipment constructed for this purpose. Either fresh air or return air from the oven, depending upon the humidity desired, is forced through a spray chamber, the temperature of which is thermostatically regulated. The saturated air, after passing through an entrainment separator and over the bulb of a Cenco precision thermometer, goes through a heater which serves to prevent condensation and also to preheat the moist air before introduction into the aging oven.

Relative humidity is defined as the ratio of w, the weight of water vapor occupying a volume v, to W, the weight of water vapor in volume V, at saturation. Therefore, for determining the operating temperature of the spray chamber required to give a definite relative humidity in the oven, use was made of saturated vapor densities obtained from steam tables.

Gravimetric determinations of the amount of water vapor in the mixture leaving the spray chamber showed that saturation was complete within the limits of accuracy of the method, estimated at 0.5 per cent.

Standard Methods

Washing of Bleached Pulps. Freshly bleached pulps were washed in the laboratory in a screen box fitted with a muslin bottom. A strong stream of water at 95 deg. F. was used and the washing continued for fifteen minutes. It was found that further washing by this method made no perceptible difference in subsequent aging behavior. Moreover, washing with distilled water at this point gave the same results as did the use of city water. After washing, the pulp was pressed by hand to 20 per cent density and thoroughly blended before storage or use.

Procedure for Making Air-Dried Sheets. Preliminary tests showed that there were sufficient impurities in the city water available to lower the initial reflectance of handsheets prepared with this water. Therefore, distilled water was used during the disintegration of the pulps prior to sheet formation and also in the sheetmaking equipment.

In the case of the bleached sulphite pulp studied, reuse of the white water lowered the initial reflectance of the sheets about 1 per cent. It was proved that the material causing this reduction in reflectance could be removed from the white water by filtration and, thus, was part of the pulp.

Reuse of the white water in sheetmaking was adopted, since the amount of the fines present will be influenced in amount and character by the prior processing of the pulp. If a classification of the pulp is permitted in the sheetmaking operation, the relation of results obtained from sheets so manufactured to previous pulp treatment will be distorted.

Any sheet-drying method employing elevated temperatures reduces the reflectivity of a pulp, the magnitude of this reduction depending upon the color stability of the pulp. Air-drying of sheets was adopted because it was believed that this type of drying would be most sound, fundamentally.

The pulp, wet or dry lap, is broken up with distilled water in the disintegrator of the British sheet-making equipment. A standard speed of 5000 r.p.m. is used.

Sheets weighing 5.0 grams air-dry are then formed on the Rapid Kothen sheet machine. Fifteen liters of white water are recirculated in the equipment. The white water is prepared by putting fresh distilled water in the equipment with every change of type of pulp and forming and discarding the first five sheets made in the new series.

When formation is complete a new 20-cm. filter paper is placed on the wet web, and on top of this a blotter which has not been used more than twice. A lightweight couch roll is then run over the stack, and the blotter is removed; the wet sheet and filter paper are removed together from the wire.

The wet sheet, having the filter paper couched to the felt side, is then laid with the filter paper against a new blotter. A Monel metal plate, 8 inches square, 16-gage, and having a no. 5 finish, is then placed on the sheet, i.e., against the wire side. The unit is then composed of: new blotter, felt side up; filter paper; wet sheet, felt side against the filter paper; and Monel plate against the wire side of the wet sheet.

After eight units have been made, the stack is pressed at 50 lb. per sq. in. for two minutes. After pressing, the blotters are removed. The sheets, with the filter paper adhering, are dried in a current of air at room temperature. When dry, the sheets break away from the surface of the plate. The filter paper is then removed and each sheet is cut into five tabs 2-⅜ inches square.

A question may arise as to the advisability of using the filter paper. It serves only to protect the sheets from dust and similar contamination. A careful study of the possibility of diffusion of material from the pulpsheet to the filter paper during drying with a resultant increase in reflectances or improvement in aging characteristics of the pulpsheets showed that the filter paper was without measurable effect.

Reflectance Measurements. Reflectance measurements were made with the General Electric recording spectrophotometer (GERS), reflectance values being taken at a wavelength of 458 mmu. in comparison with a magnesium carbonate standard. These values were used in this study for the following reasons.

In the case of undyed pulp and paper, reflectance curves are similar in form, showing minimum reflectance in the violet and maximum reflectance in the red, with a gradual increase in reflectance from violet to red. This is true for both bleached and unbleached pulps. When the color changes of aging occur, the reflectance drops throughout the visible range, the greatest decrease taking place in the blue and violet region. Thus, the most sensitive measure of color change in pulp is the reflectance at any wavelength in the blue or violet.

The wavelength of 458 mmu. was arbitrarily selected because it corresponds to the dominant wavelength transmitted by the Wratten filter used in the General Electric reflection meter for the measurement of brightness.

However, the reflectivity measurements made with the GERS must not be confused with brightness. In the GERS the sample is illuminated normally to its surface and the photocell views the reflectance by means of an integrating sphere. This method of illuminating and viewing eliminates irregularity of sample surface as a possible source of error.

The illumination of the sample in the General Electric reflection meter is at an angle of 45 degrees and viewing is normal to the surface. The brightness readings on the latter instrument are approximately 95 per cent of the reflectivity measurements obtained with the GERS.

The initial reflectance of the handsheets was determined within two hours after the sheets were dry.

The reflectance of the aged samples was determined nine to twelve hours after removal from the aging open. This time was chosen because it was found that, after removal from the aging atmosphere, the reflectance of the sheets tended to increase slightly for six hours. The maximum increase observed was 0.5 per cent. It was not possible to relate this increase in reflectivity to the degree of discoloration, to the humidity of the aging atmosphere, or to other factors. Equilibrium appeared to be established after six hours and remained unchanged for at least an additional twelve hours.

Methods of Oven Aging. Small wooden racks were made and fitted with paper clips in such a way that the five tabs from one sheet could be held and the sheets separated to allow free circulation of air over their surfaces. One rack was prepared for each aging interval, so that a number of sheets could be transferred quickly in or out of the oven.

After the oven and humidifying chamber had been adjusted to the desired temperatures and had operated sufficiently long to ensure equilibrium conditions, the samples were introduced by shutting down the circulation fan in the oven and quickly introducing the rack. Opening the oven door disturbed the equilibrium, but only to the extent of one or two degrees, as indicated by the thermometers. The exact equilibrium conditions were reestablished within four minutes when operating at 95 deg. C. and 55.4 per cent relative humidity, and even more rapidly at the lower humidities.

The introduction and the removal of samples were timed to give a minimum number of disturbances.

Derivation of Rate of Discoloration from Reflectivity Data and Aging Time. The method used for deriving a numerical index for the rate of discoloration from reflectivity and time of aging data was developed by Tongren *(1)*.

The first step is the conversion of the reflectivity to the corresponding Kubelka and Munk number, *K/S*. The equation for this conversion is:

$$K/S = (1 - R)^2 / 2R,$$

where R = the reflectivity of the pad of paper expressed decimally against magnesium carbonate considered as 0.98,
S = the scattering coefficient of the furnish, and
K = the absorption coefficient of the furnish.

Note: The number *S* is considered to be nearly constant throughout the course of aging, so that change in the value *K/S* expresses the change in the light-absorptive capacity of the sheet.

The fundamental equations developed by Kubelka and Munk which deal with the above relationship have been presented in useful form by Steele *(3)*. In applying the *K/S* number to the determination of

a numerical rate of discoloration, Tongren plotted the K/S numbers as ordinates against the square root of the hours of aging time. This gave a straight line, the slope of which was taken as an index of the rate of discoloration.

This method has been applied to the reflectivity-time data obtained in the present investigation, and the discoloration rates are expressed in these terms.

Experimental Procedure and Results

Effect of Temperature and Humidity Upon the Rate of Discoloration

Using the procedures previously described, air-dried handsheets were prepared from a bleached commercial Mitscherlich sulphite pulp. The pulp was made from sprucewood and was obtained from the mill freshly bleached and in slush form. Sets of these sheets were aged for 3 hr. at temperatures of 75, 85, and 95 deg. C., respectively, under various humidity conditions.

The moisture content of the sheets in the aging atmosphere was determined by extending a wire from the beam of an analytical balance into the aging oven and shutting down the blowers momentarily while determining the equilibrium weight of a sample suspended from the wire. The ovendry weight of the sample was then determined by drying at 105 deg. C.

Since the tests made in this section included only one aging period, the standard method of calculating discoloration rates is not applicable. However, by subtracting the K/S value of the aged pulp and dividing the figure so obtained by the square root of three, discoloration rates which are comparable with those by the standard method are obtained. The results of this study are presented in Table I.

TABLE I.—BLEACHED SULPHITE PULP OVEN AGED THREE HOURS UNDER VARIOUS TEMPERATURE AND HUMIDITY CONDITIONS

Initial unaged reflectance—82.95 per cent; Initial unaged K/S number —0.01752

Oven temp., deg. C.	Relative humidity, per cent	Aged reflectance, per cent	Aged K/S no.	Moisture content, per cent	Calcd. aging rate
95	1.8	74.6	0.0432	...	0.01480
	27.8	76.0	0.0379	3.01	0.01178
	53.3	72.6	0.0517	5.58	0.01971
	81.6	67.9	0.0759	9.21	0.03350
85	2.7	76.8	0.0350	...	0.01010
	2.9	76.9	0.0347	...	0.00993
	9.6	77.2	0.0337	1.21	0.00935
	20.1	77.8	0.0317	2.30	0.00818
	40.8	76.2	0.0372	4.40	0.01140
	56.8	74.8	0.0424	6.28	0.01453
	78.0	72.8	0.0508	8.72	0.01920
75	30.6	79.3	0.0270	3.42	0.00548
	59.1	78.4	0.0297	6.97	0.00705
	81.0	77.1	0.0340	9.51	0.00952

Effect of Humidity Upon Rate of Discoloration

The results obtained in the foregoing section confirm the work of Tongren, namely, a linear increase in discoloration rate with increase in relative humidity for the range of relative humidities above 25 per cent. However, in addition, the present work shows a minimum aging rate at a relative humidity of about 20 per cent.

It seemed possible, inasmuch as no similar minimum discoloration rate had been reported previously, that the minimum rate observed might be peculiar to the pulp studied. If it should be true that various pulps react differently to the humidity variable, this fact would have an important bearing on comparative accelerated aging evaluations. The apparent relative stability of the pulps tested would then depend upon the humidity of the atmosphere used for the aging test.

In order to investigate this possibility, three other types of pulp were studied: a purified hardwood sulphite, a bleached soda, and a quick-cook bleached sulphite. These pulps were received as dry lap pulp. Air-dried handsheets of the three pulps were prepared and aged, together with samples of a Mitscherlich pulp of the type used in the preceding section.

The code numbers, initial unaged reflectance, and K/S values of these pulps are listed in Table II.

TABLE II.—PULPS USED IN AGING TESTS

Type of pulp	Code no.	Initial reflectance per cent	Initial K/S no.
Purified hardwood sulphite	H	90.52	0.00496
Bleached soda	S	82.88	0.01767
Quick-cook sulphite	F	81.45	0.02112
Mitscherlich	7	83.29	0.01676

The aging tests were made at 95 deg. C. at various relative humidities; the time of aging was three hours. The moisture content of the sheets in the aging atmosphere was determined as before.

The discoloration rate was calculated by subtracting initial K/S numbers from aged K/S numbers and dividing by the square root of three. It should be emphasized that this method of rate determination is not recommended because it is a two-point slope determination. It is used only to convert these data to aging rate of the type used throughout this discussion. Table III contains the aging data and calculated aging rates for the four types of pulp.

TABLE III.—PULPS AGED FOR THREE HOURS AT 95 DEG. C. AT VARIOUS RELATIVE HUMIDITIES

Pulp	Relative humidity per cent	Aged reflectance per cent	Aged K/S no.	Moisture content per cent	Calcd. aging rate
H	1.94	88.16	0.00796	0.20	0.00173
	10.2	87.97	0.00822	1.07	0.00188
	20.8	87.14	0.00931	2.10	0.00251
	54.8	85.04	0.01316	5.30	0.00473
S	1.94	78.30	0.03007	0.30	0.00716
	10.2	76.50	0.03609	1.20	0.0106
	20.8	74.10	0.04526	2.30	0.0159
	54.8	67.30	0.07932	4.90	0.0356
F	1.94	77.24	0.03348	0.20	0.00713
	10.2	77.16	0.03383	1.07	0.00735
	20.8	76.88	0.03476	2.10	0.00786
	54.8	74.38	0.04412	5.30	0.01330
7	1.94	76.78	0.03511	0.25	0.0106
	10.2	77.32	0.03327	1.17	0.0095
	20.8	76.30	0.03574	2.27	0.0109
	54.8	71.55	0.05676	5.75	0.0231

The important fact demonstrated by this series of aging tests is that the relative discoloration rates of various pulps at an elevated temperature are dependent upon the humidity of the aging atmosphere. For example, the sola pulp, if rated for color stability by aging at 95 deg. C. at any relative humidity below 10 per cent, would be superior to the Mitscherlich pulp, but at relative humidities above 10 per cent, the soda pulp would show up as less stable in color than the Mitscherlich.

The fact that the reversal of discoloration rate occurs in the range below the fiber saturation point suggests that the phenomena may be the result of a physical change in the fiber caused by dehydration. Since this extreme dehydration does not occur under natural aging conditions, the conclusion is reached that accelerated aging tests should be conducted under conditions which will maintain a normal amount of moisture in the pulpsheets.

Although a comparison of the naturally occurring discoloration rates with the accelerated discoloration rates will be presented later, it is of importance to note here that this comparison supports the view that maintenance of a normal moisture content in the sheets during accelerated aging gives results more nearly paralleling the effects of natural color change.

Effect of Treatment of a Pulp Prior to an Accelerated Color Stability Evaluation on the Results of This Evaluation

The effect of machine-drying pulp upon color stability under various accelerated aging conditions. Inasmuch as the Mitscherlich pulp in the preceding section was the only pulp not obtained in the form of dry laps, the possibility arose that machine drying of the other pulps might have eliminated their tendency to show a minimum discoloration rate. In order to determine the effect of machine drying upon the Mitscherlich pulp, a fresh sample was obtained and a number of wet sheets, 8 inches square and of an average pulp lap weight, were made. Alternate laps were then dried on a Noble and Wood thermostatically-controlled drum drier to a moisture content of 35 per cent.

Standard air-dried sheets were prepared from the machine-dried pulp (Pulp 9) and from the wet lap pulp (Pulp 10). Accelerated aging tests were made at 95 deg. C. and at various relative humidities. The initial reflectance values of the pulps and the aging data are shown in Table IV.

TABLE IV.—ACCELERATED AGING DATA FOR PULPS 9 AND 10

Aging test conducted at 95 deg. C.
R = Percentage reflectance

A. Machine-dried pulp (9); Unaged, R = 82.49, K/S = 0.01858					
Aged, hr.	0.5	1.5	3.0	6.0	9.0
2.08 per cent relative humidity					
R	79.45	78.00	77.20	76.45	75.45
K/S	0.02658	0.031025	0.03367	0.03727	0.03994
10.1 per cent relative humidity					
R	79.48	79.00	78.08	77.00	76.42
K/S	0.02645	0.02791	0.03076	0.03435	0.03638
21.7 per cent relative humidity					
R	79.52	78.62	77.64	76.66	75.70
K/S	0.02638	0.02907	0.03220	0.03554	0.03900
55.4 per cent relative humidity					
R	77.71	76.14	74.30	72.48	71.18
K/S	0.03196	0.03739	0.04444	0.05224	0.05832
B. Slush to wet lap pulp (10); Unaged, R = 85.65, K/S = 0.01201					
2.08 per cent relative humidity					
R	77.92	76.03	74.47	72.28	70.60
K/S	0.03128	0.03779	0.04476	0.05315	0.06121
10.1 per cent relative humidity					
R	78.31	76.44	75.22	73.53	72.70
K/S	0.03004	0.03620	0.04082	0.04768	0.05126
21.7 per cent relative humidity					
R	78.75	76.80	75.30	74.00	72.94
K/S	0.02867	0.03504	0.04051	0.04567	0.05019
55.4 per cent relative humidity					
R	76.50	73.79	71.70	68.91	67.84
K/S	0.03690	0.04654	0.05585	0.07914	0.07623

Discoloration rates of the pulps at the given humidities were calculated by the standard method. The rates are tabulated in Table V.

TABLE V.—DISCOLORATION RATES AT 95 DEG. C. AND VARIOUS RELATIVE HUMIDITIES OF AIR-DRIED SHEETS MADE FROM MACHINE-DRIED AND SLUSH PULP

Pulp	Relative humidity, per cent 2.05	10.1	21.7	55.4
9	0.00603	0.00460	0.00540	0.0120
10	0.0128	0.0103	0.0091	0.0183

These results show that machine-drying of the pulp caused a pronounced decrease in the discoloration rate, the greatest percentage decrease occurring in the range of 2 per cent relative humidity; in addition, the point of minimum discoloration has been shifted toward the lower relative humidities.

This study of the effect of the machine-drying of pulp on the accelerated discoloration rate was extended by preparing wet laps from a slush sample of Mitscherlich pulp which was three weeks old, dividing the wet laps into groups, and drying on the Noble and Wood drier to various degrees.

Air-dried handsheets were prepared and the sheets aged at 95 deg. C. under various relative humidities for 0.5, 1.5, 3.0, 6.0, and 9.0 hour intervals as before. The pulp numbers, moisture content to which the laps were dried, initial reflectance values, and the discoloration rates calculated from the aging data are shown in Table VI.

TABLE VI.—DISCOLORATION RATES AT 95 DEG. C. OF AIR-DRIED SHEETS FROM SLUSH PULP AND FROM PORTIONS OF THIS PULP MACHINE-DRIED TO VARIOUS DEGREES

Relative humidity of the aging atmosphere as indicated in the table				
Pulp	14	11	12	13
Lap H_2O, per cent.....	Slush	52.4	19.6	5.5
Initial reflectance	83.86	83.02	82.89	82.64
Relative humidity per cent	Discoloration rate			
2.0	0.00790	0.00413	0.00330	0.00295
10.0	0.00716	0.00395	0.00275	0.00228
21.7	0.00710	0.00470	0.00360	0.00322
55.4	0.0136	0.0116	0.00975	0.00925

In Fig. 1, the rates of discoloration of the air-dried sheets prepared from the slush pulp and the machine-dried pulps are plotted against the relative humidity of the aging atmosphere.

Here again, the increase in color stability and the shift in the point of minimum discoloration brought about by machine-drying the pulp is demonstrated. Much greater percentage increases in color stability are shown by the aging tests conducted at the lower relative humidities, and this further emphasizes the effect of the aging atmosphere upon the results of accelerated aging tests. The major portion of the increase in color stability to be gained by machine-drying this pulp is accomplished by drying to 20 per cent moisture. Machine-drying the laps to a moisture content as low as 5 per cent does not eliminate the minimum in the discoloration rate-relative humidity relationship.

In a consideration of reasons for the increased color permanency of the machine-dried pulp, several possibilities were investigated. The equilibrium moisture content of the pulpsheets in the aging atmosphere was determined, but no significant difference between the sheets from dried and undried pulp was

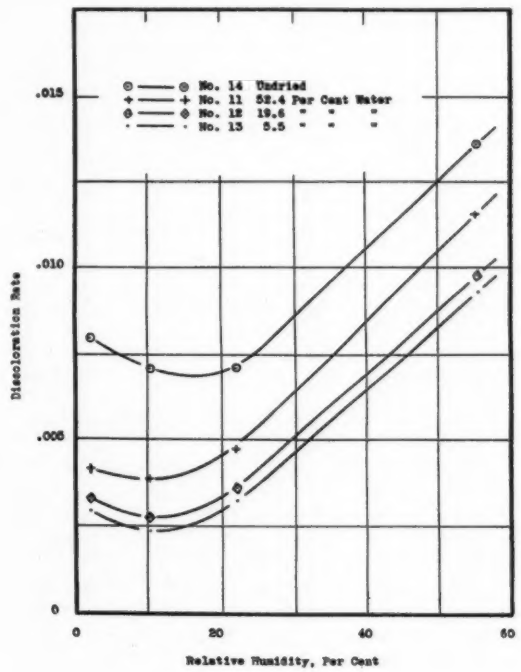

FIG. 1.

found. It is conceivable that during the machine-drying process a concentration of alkalinity from the water might take place in the fiber. However, ash determination showed no appreciable difference in total mineral content. To investigate whether or not volatile acidic constituents had been driven off by machine-drying, the *p*H of the hot water extract of the sheets was determined. Loss of acidity by volatilization could result from the elimination of hydrochloric acid through hydrolysis of residual calcium chloride or of chlorinated organic impurities. No difference in the *p*H of the water extract of the two types of sheets was found.

Other theories advanced as possible explanations of why sheets from machine-dried pulp should exhibit such a marked improvement in resistance to color aging were: that some physical change had occurred in the fibre structure which contributed to a decreased chemical reactivity; that a change in the nature of the material producing the discoloration took place during heat drying; and that during machine-drying the impurities diffused from the interior structure of the fiber and deposited upon the surface, to be removed in the subsequent sheetmaking operation.

Up to this point all determinations of the effect of machine-drying pulp on color permanency under accelerated aging conditions were made on air-dried handsheets; this precludes estimation of the difference which might be expected between papers made from slush and machine-dried pulp, respectively. In order to investigate the effect of machine-drying pulp on color permanency from the viewpoint of the effect on finished paper, the following study was made.

Wet laps were prepared from a freshly bleached Mitscherlich pulp and alternate laps were dried on the Noble & Wood drier to a moisture content of 19.5 per cent. Air-dried handsheets were prepared from the two types of laps by the standard procedure.

To simulate the manufacture of a commercial waterleaf paper from the two types of laps, sheets were prepared and dried by heat. The sheetmaking procedure up to and including the wet pressing was identical with that of the standard method. Instead of drying the sheets on the Monel plates at room temperature, the plates with the wet sheets adhering were placed in the aging oven at 95 deg. C. and 55.4 per cent relative humidity, and dried. Seventeen minutes were required. Handsheets so dried will be termed machine-dried.

It is realized that this length of drying time is far from the range of the paper machine drying time, but by this means overdrying was avoided. Since the conditions were identical for the sheets prepared from the wet lap and from the machine-dried pulp, analysis based on percentage difference should be valid. The various sheets were aged at 95 deg. C. and 55.4 per cent relative humidity. The results are shown in Table VII.

TABLE VII.—COMPARISON BETWEEN AIR-DRIED SHEETS AND MACHINE-DRIED SHEETS FROM SLUSH AND MACHINE-DRIED PULP, RESPECTIVELY

R = Per cent reflectance; T = Hours aged at 95 deg. C. and 55 per cent r.h.

Sheets	18	18-E	19	19-E
Type pulp drying	Machine	Machine	Wet lap	Wet lap
Type sheet drying	Air	Machine	Air	Machine
Initial reflectance	84.91	82.94	86.92	82.54
Initial K/S no.	0.01341	0.01754	0.00984	0.01847
T = 1.0, R	79.76	79.87	77.01	77.63
K/S	0.02754	0.02528	0.03374	0.03223
T = 3.0, R	77.04	77.50	73.61	74.96
K/S	0.03421	0.03266	0.04730	0.04184
T = 6.0, R	75.16	75.68	71.24	73.16
K/S	0.04105	0.03908	0.05805	0.04923
T = 9.9, R	73.52	74.30	69.18	71.50
K/S	0.04769	0.04445	0.06865	0.05675
Discoloration rate	0.0109	0.00915	0.01735	0.01175

Comparing the discoloration rates of the air-dried handsheets from wet lap (Sheet 19) and machine-dried pulp (Sheet 18), the rate of the latter is seen to be 62.8 per cent of the former. In the case of the machine-dried handsheets, the difference is not as great, although it is still pronounced. The rate of discoloration of the machine-dried handsheets (Sheet 18-E) from the machine-dried pulp is 77.8 per cent of the rate of similarly dried sheets (Sheet 19-E) from wet lap pulp. The improved color stability of the machine-dried handsheets from the machine-dried pulp is very evident from the reflectivities at the various aging intervals. Thus, it appears that, under commercial conditions, a significant improvement in color stability may result from machine-drying pulp prior to use.

A further result of this study is the elimination of the theory previously suggested, that a diffusion of material to the surface of the fiber occurs during machine-drying and that removal of this material during subsequent sheetmaking is responsible for the improved color stability. Comparison of the aging rates of Sheets 19 and 19-E illustrates this point. The latter sheets were in their final form when subjected to a machine-drying treatment, and this operation reduced the discoloration rate to 67.5 per cent of the air-dried sheet rate.

The effect upon subsequent accelerated discoloration rate of heating air-dry sheets. Having observed that machine-drying wet handsheets caused an increase in color stability comparable with that occurring if the wet pulp laps were machine-dried prior to the sheet forming process, it was considered advisable to determine if heating of air-dry handsheets exerted an influence upon the subsequent rate of accelerated aging.

For this purpose handsheets of the series 18, 18-E, 19, and 19-E were used. These sheets, which were in equilibrium with the atmosphere at 70 deg. F. and 65 per cent relative humidity, were treated in the aging oven at 95 deg. C. and 55.4 per cent relative humidity for seventeen minutes. This reduced the reflectivities from the initial values shown in Table VII to 82.06, 81.48, 79.97, and 79.89 per cent for 18, 18-E, 19, and 19-E, respectively. The sheets were then subjected to an accelerated aging treatment at 95 deg. C. and 55.4 per cent relative humidity, the reduced reflectance values being considered as the initial reflectance. The results of this determination as compared with the discoloration rates of the untreated sheets are shown in Table VIII.

TABLE VIII.—COMPARISON OF DISCOLORATION RATES AT 95 DEG. C. AND 55.4 PER CENT RELATIVE HUMIDITY OF SHEETS GIVEN SEVENTEEN-MINUTE HEAT TREATMENT IN AIR-DRY CONDITION WITH DISCOLORATION RATES OF UNTREATED SHEETS

Sheets	18	18-E	19	19-E
Heat-treated	0.0112	0.0080	0.0172	0.0110
Untreated	0.0109	0.0091	0.0173	0.0117

The data of Table VIII show that the seventeen-minute heat treatment of sheets, which were in an air-dry condition prior to and during the heat treatment, did not alter significantly the results of the accelerated aging tests for color stability in the case of Sheets 18 and 19. In the case of sheets 18-E and 19-E, the rate seems to have been reduced to the extent of about 8 per cent by the heat treatment. The reason for this reduction is not clear. Both of these latter sheets were machine dried. Sheets 18 and 19, being the air-

dried sheets, would be expected to be more susceptible to a change in rate by the additional heating, but they were unaffected.

The conclusion is reached that, in the range studied, the application of heat to air-dry sheets does not change the subsequent accelerated rate of discoloration of the sheets. The improvement in color stability occurring as a result of machine-drying, therefore, must result from the action of heat in the presence of excess water or from some effect taking place by reason of the rapid evaporation of water from the sheet during drying.

Effect of hot water extraction of pulp upon the color stability at 95 deg. C. under various relative humidity conditions. In order to compare the effect on color permanency of hot water extraction of pulp with machine-drying of the pulp, a portion of Pulp 14 was treated at 1.0 per cent consistency and 95 deg. C. for twenty minutes. At the end of the extraction, the suspension was filtered on a Büchner funnel, care being taken to avoid loss of fine fractions. The pulp was not washed after filtration; the excess water was removed by pressing to about 20 per cent dry fiber. City water was used in the extraction of Pulp 15 and distilled water in the extraction of Pulp 16.

Standard air-dried handsheets were prepared from the pulps and aging tests were made at 95 deg. C. and various relative humidities. The discoloration rates were determined from the time-reflectivity data and are listed in Table IX; they are shown graphically in relation to relative humidity in Fig. 2.

TABLE IX.—DISCOLORATION RATES AT 95 DEG. C. OF AIR-DRIED SHEETS FROM SLUSH PULP AND FROM PORTIONS OF THIS PULP AFTER HOT WATER EXTRACTION

Relative humidity of the aging atmosphere as indicated in the table

Pulp	14	15	16
Treatment	Untreated	City water-extd.	Dist. water-extd.
Initial reflectance, per cent	83.86	80.30	81.75
Relative humidity, per cent	Discoloration rate		
2.0	0.00790	0.00492	0.00503
10.1	0.00716	0.00340	0.00350
21.7	0.00710	0.00386	0.00380
55.4	0.0136	0.00968	0.01025

The discoloration rates of the pulps extracted with distilled and with city water are not significantly different at 2.0, 10.1, and 21.7 per cent relative humidity, respectively; however, at 55.4 per cent relative humidity a slightly lower rate is indicated for the pulp extracted with city water. If Figs. 1 and 2 are compared it will be noted that at 55.4 per cent relative humidity the change in discoloration rate caused by the hot water extraction is similar to that occurring when the pulp is machine-dried to 20 per cent moisture content, but that hot water extraction does not cause as great a reduction in discoloration rate at the low relative humidities as does machine-drying the pulp. In addition, the water extraction did not shift the minimum aging rate toward the lower relative humidities.

Comparative effects on color stability of saturated vapor treatment, hot water extraction, and machine drying of pulp. In the work done up to this point, it has been demonstrated that by machine-drying handsheets an increase in color stability comparable with that obtained by machine-drying the pulp prior to sheetmaking was obtained. Also it was demonstrated that no increase in permanency occurred when air-dried sheets initially containing 8 per cent moisture were heated. Thus, it was certain that the stabilizing action took place only in the presence of considerable moisture. It is of importance to know whether or not this increase in color permanency was a result of the rapid evolution of steam during drying, with the attendant loss of some volatile constituent, or whether the action would also take place under conditions allowing no volatilization or drying of the sheets.

In order to study this point, a slush Mitscherlich pulp was obtained, and sheets were prepared according to the standard method up to, and including, the wet pressing. Two Monel plates, with the wet sheets adhering, were placed with the sheet surfaces together, and clamps applied to hold them tightly in this position. In this way, the two wet sheets were sealed between the plates, the outer edges of the sheets themselves serving to prevent movement of vapors. Sheets encased in this way were then heated in the aging oven at 95 deg. C. and 100 per cent relative humidity for periods of seven, fifteen, and thirty minutes, respectively. At the conclusion of the heating interval, the plates were removed from the oven, cooled, and the sheets air-dried.

For purposes of comparison, a series of machine-dried sheets from the untreated pulp and a series of air-dried sheets from the pulp extracted with distilled water were made up. The machine-dried sheets were dried for seven, fifteen, and thirty minutes, respectively, at 95 deg. C. and 55.4 per cent relative humidity. Since the first two periods were too short to give drying to the equilibrium condition, the drying was completed at room temperature in a current of air. The hot water extraction was likewise carried out at 95 deg. C. for seven, fifteen, and thirty minutes, and air-dried handsheets were prepared from the treated pulps.

Discoloration rates of the various sheets were determined at 95 deg. C. and 55.4 per cent relative humidity, and in Table X these rates are shown expressed as percentages of the discoloration rate of standard air-dried handsheets prepared from the untreated base pulp.

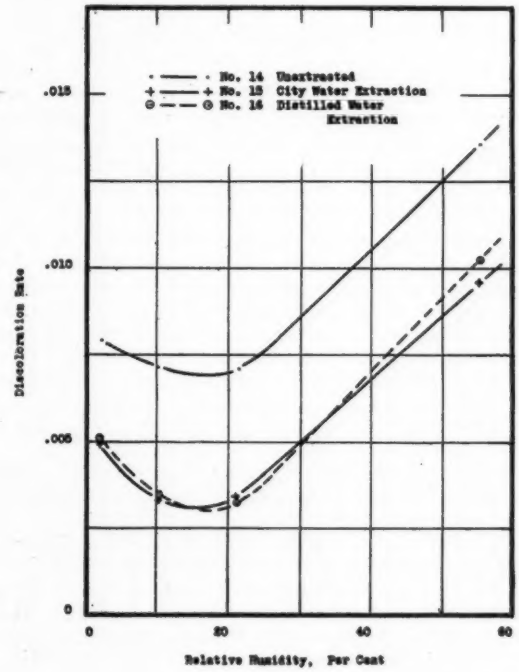

FIG. 2.

TABLE X.—DISCOLORATION RATES AT 95 DEG. C. AND 55.4 PER CENT RELATIVE HUMIDITY OF SHEETS FROM SATURATED VAPOR TREATMENTS, MACHINE-DRYING TREATMENT, AND DISTILLED WATER EXTRACTION EXPRESSED AS A PERCENTAGE OF THE DISCOLORATION RATE OF STANDARD AID-DRIED SHEETS MADE FROM THE UNTREATED PULP

Time treated minutes	Saturated vapor 95 deg. C. per cent	Machine-dried 95 deg. C., 55.4 per cent relative humidity, per cent	Distilled Water extraction, per cent
7	74.6	73.0	73.7
15	74.6	68.2	71.2
30	72.4	67.1	67.4

The results obtained from this study show definitely that the major part of the improvement in color stability obtained by machine-drying this sulphite pulp is due to the combined action of heat and excess moisture on the fiber, or some constituent thereof, and that removal of any material by volatilization or washing is unnecessary in securing the observed improvement.

Effect of wet storage of pulp upon its subsequent accelerated rate of discoloration. Frequently considerable time may elapse between the completion of the bleaching operation and the time that sheets are prepared for testing purposes. In order to study the effect of wet storage on the accelerated color aging tests, a well-washed sample of freshly bleached Mitscherlich pulp was pressed to 20 per cent dry fiber content, thoroughly blended, and stored in a glass container protected from light. Samples of the moist pulp were withdrawn at the desired intervals and made up into standard air-dried handsheets. Discoloration rates at 95 deg. C. and 55.4 per cent relative humidity were determined. The data obtained in this study are shown in Table XI.

TABLE XI.—EFFECT OF WET STORAGE UPON THE INITIAL REFLECTANCE AND UPON THE RATE OF DISCOLORATION AT 95 DEG. C. AND 55.4 PER CENT RELATIVE HUMIDITY OF AIR-DRIED HANDSHEETS PREPARED AT INTERVALS DURING THE STORAGE PERIOD

Sheet	Wet storage, days	Initial reflect. per cent	Initial K/S no.	Discoloration rate	Rate as percentage of initial
20	0	89.35	0.00634	0.02446	...
24	4.0	88.00	0.00818	0.02100	85.8
25	8.0	88.07	0.00960	0.02008	81.9
26	14.0	86.80	0.01004	0.01920	78.4
28	19.0	86.13	0.01118	0.01863	76.2
29	30.0	85.64	0.01204	0.01790	73.2

When the initial K/S numbers of the sheets made at the respective storage intervals and the square root of the hours in storage are plotted as in the standard method of discoloration rate determination, a rate index of 0.000215 is obtained. The decrease in the accelerated discoloration rate with increasing time in storage shows the importance of maintaining a definite time interval between the end of the bleaching operation and the time of sheetmaking, if comparative results are desired. The decrease in aging rate may be due to the diffusion of impurities from the structure of the fiber and their removal during sheetmaking. On the other hand, it has been demonstrated that, in machine-drying sheets, the removal of any material from the sheet seems improbable. The same type of stabilizing reactions may occur during wet storage but at a much slower rate because of the low temperature.

Effect of dry storage or "natural aging" upon subsequent accelerated rate of discoloration. The reflectivity of dry handsheets often decreases considerably before accelerated aging tests can be made. The effect of this color change on the accelerated discoloration rate determination was investigated by storing part of the air-dried handsheets made from Pulps 9 and 10 and, after a period of thirty days, reevaluating the discoloration rates.

The handsheets were stored in the dark at 70 deg. F. and 65 per cent relative humidity. At the end of the thirty days, the reflectance of sheets from Pulp 9 had decreased from 82.49 to 80.25 per cent, and those from Pulp 10 from 85.65 to 80.42 per cent. The result of the discoloration rate determinations at 95 deg. C. on the stored samples are shown in Table XII and compared with the rate determinations made immediately after preparation of the sheets.

TABLE XII.—COMPARISON BETWEEN DISCOLORATION RATES AT 95 DEG. C. OF FRESHLY PREPARED SHEETS AND SHEETS STORED THIRTY DAYS BEFORE TESTING

Relative humidity, per cent.		2.08	10.1	21.7	55.4
Sheet	Time tested	Discoloration rate			
9	At once	0.00603	0.00460	0.0054	0.0120
9	After 30 days.....	0.00681	0.00566	0.00640	0.0123
10	At once	0.0128	0.0103	0.0091	0.0183
10	After 30 days.....	0.0127	0.0106	0.0087	0.0184

It will be seen that no change in aging rate has occurred in the case of the air-dried sheets from slush Pulp 10, despite the large decrease in reflectance which took place during storage, showing that this method of discoloration rate determination is independent of the initial reflectance of the pulp.

In the air-dried sheets from machine-dried Pulp 9, the increase in the aging rate is significant and indicates that the color stabilizing effects of machine drying may not be entirely permanent.

Relation of accelerated discoloration rate to rate of naturally occurring discoloration. The rate of naturally occurring discoloration was obtained in the following manner. Five representative handsheets were taken from each series of sheets made and cut into five tabs, as for oven-aging tests. Initial reflectance values were determined, and the tabs stored in the constant humidity room in a lightproof container. At desired intervals of storage the reflectance of the sample was measured. The results of the reflectance measurements, when converted to the corresponding K/S values and plotted against the square root of the hours in storage, gave linear relationships. The slope of these lines, as in the similar treatment of accelerated aging data, was taken as a measure of the rate of discoloration.

In Table XIII the natural rates of discoloration of the samples in comparison with the rates as determined at 95 deg. C. and 2.0 and 55.4 per cent relative humidity, respectively, are recorded in the order of increasing stability under the conditions given.

TABLE XIII.—DISCOLORATION RATES EXISTING UNDER NATURAL STORAGE CONDITIONS IN COMPARISON WITH DISCOLORATION RATES AS MEASURED AT 95 DEG. C. AND 2.0 PER CENT AND 55.4 PER CENT RELATIVE HUMIDITY, RESPECTIVELY

2.0 per cent relative humidity, 95 deg. C.		Natural storage conditions		55.4 per cent relative humidity, 95 deg. C.	
Pulp	Rate	Pulp	(Rate × 100)	Pulp	Rate
10	0.0128	S	0.0800	S	0.0350
7	0.0106	10	0.0462	10	0.0186
14	0.00790	7	0.0430	7	0.0157
S	0.00716	F	0.0342	14	0.0136
F	0.00713	14	0.0288	F	0.0123
9	0.00602	9	0.0242	9	0.0120
16	0.00503	11	0.0172	11	0.0116
15	0.00492	13	0.0166	16	0.0102
11	0.00413	12	0.0165	12	0.00975
12	0.00330	16	0.0122	15	0.00968
13	0.00295	H	0.0066	13	0.00925
H	0.00173	15	0.0060	H	0.0056

The criterion of the ideal accelerated aging test is that rates of discoloration so obtained be reduced to the magnitude of natural aging rates by a multiple common to all types of pulp. The data obtained in this study do not satisfy this condition. The departure

TABLE XIV.—REFLECTIVITY CHANGE AND DISCOLORATION RATE OF NATURALLY AGING SHEETS FROM MACHINE-DRIED AND WET LAP PULP

T = Days aged; R = Percentage reflectivity

Pulp 18 Air-dried sheets from machine-dried pulp			Pulp 19 Air-dried sheets from Wet lap pulp			Pulp 18-E Machine-dried sheets from machine-dried pulp			Pulp 19-E Machine-dried sheets from wet lap pulp		
T	R	K/S	T	R	K/S	T	R	K/S	T	R	K/S
0	84.91	0.01341	0	86.92	0.00984	0	82.94	0.01754	0	82.54	0.01847
5.0	84.13	0.01497	6	84.51	0.01400	5.0	82.85	0.01775	6.0	81.71	0.02047
18	83.59	0.01610	19	83.10	0.01718	18	82.25	0.01915	19	81.51	0.02097
27	83.33	0.01668	28	82.54	0.01847	27	82.11	0.01949	28	81.10	0.02202
43	83.02	0.01735	44	81.64	0.02064	43	81.99	0.01978	44	80.64	0.02323
Rate = 0.000116			Rate = 0.000335			Rate = 0.000070			Rate = 0.000132		

seems to arise partly from the fact that color stabilizing effects brought about by heat treatments or by extractions have a greater percentage effect on natural aging rate than upon accelerated rate.

In judging which relative humidity of aging atmosphere at 95 deg. C. gave results most closely paralleling the effects of natural aging, there is no significant difference between 2.0 and 55.4 per cent, if the sulphite pulps alone are considered. However, when the soda pulp used in this study is considered in the comparison, it is immediately evident from Table XIII that the accelerated aging at 55.4 per cent relative humidity gave the best correlation with the naturally occurring rate of discoloration.

Effect of Machine-Drying Pulp Upon the Color Stability Under Natural Aging Condition

In order to give a better concept of the meaning of natural discoloration rate in terms of reflectance changes and to show the effects of machine drying upon color stability under natural storage conditions, the reflectivity-time data and discoloration rates for the series 18, 18-E, 19, 19-E as previously described are shown in Table XIV.

The behavior of the air-dried sheets is chiefly of laboratory significance. However, the reflectivity changes of the machine-dried sheets are related directly to the behavior of waterleaf papers prepared from machine-dried and wet lap pulp. The data indicate that the machine-drying procedure used on the sheets was somewhat more drastic than normally exists in commercial operation. This, however, does not obscure the fact that machine-drying the pulp has reduced the discoloration rate to approximately one-half of the value of the rate on sheets prepared from wet lap pulp. In terms of reflectivity, the sheets from the machine-dried pulp have dropped only 0.95 points in forty-three days, as against a reduction in the sheets from the wet lap pulp of 1.90 points in forty-four days.

Although these time-reflectivity data cover a period of only forty-four days, they indicate that the rate relationships observed will continue indefinitely. If this proves true, the reflectivity of these sheets may be predicted for a future time by extrapolating the K/S vs. the square root of hours aged relation to the desired time interval. A prerequisite for the validity of this procedure would be that the sheets be stored under constant temperature and humidity conditions for the entire time.

Possible Significance of the Linear Relation Between K/S and the Square Root of Time

The linear relation observed between K/S and the square root of time of aging under both natural and accelerated conditions is unusual. It is of interest to speculate on the possible significance of this fact.

It can be shown from the laws of capillary dynamics that

$$x \text{ varies as } \sqrt{T}$$

where x is the distance penetrated into the capillary structure and T is the time.

It is probable that the material responsible for the development of color during aging is distributed throughout the fiber structure. Since, for a given fiber furnish, S, the scattering coefficient in the Kubelka and Munk number is nearly constant, change in the number K/S is proportional to change in the concentration of colored material in the fiber.

If it is assumed that a reactant, such as oxygen, penetrates the colloidal fiber structure and combines with impurities to form colored products, the distance x can be assumed proportional to the increase in concentration, c, of the colored material. Thus,

$$x \text{ varies as } c \text{ varies as } T,$$

and, since K/S also is proportional to c,

$$K/S \text{ varies as } T.$$

If color changes of pulp do proceed along such a course, the rate at which discoloration proceeds will be dependent not only upon the amount of impurity present, but also upon the physical nature of the fiber. Therefore, while chemical evaluation of the pulp might measure the ultimate extent of discoloration, a physical evaluation also would be required to completely specify the rate at which the discoloration would proceed.

Literature Cited

(1) Tongren, J. C., *Paper Trade J.* 107, no. 8:34-42 (Aug. 25, 1938).
(2) Michaelson, J. L., and Liebhafsky, H. A., *Gen. Elec. Rev.* 39: 445-50, especially 445-6 (1936).
(3) Steele, F. A., *Paper Trade J.* 100, no. 12:37-42 (March 21, 1935).

A Water Soluble Cellulose Ether

From Methocel, a water soluble cellulose ether, a superior film-forming material is produced. Coatings manufactured from this material are colorless, odorless, tasteless, transparent and stable to heat and light. The properties of this interesting material seem to forecast unusual possibilities as an agent for dispersing, thickening, emulsifying, sizing and coating. Its applications to paper coating and sizing—to textile, cosmetic and paint fields as a thickening agent—its utility in preparation of pastes, sizes, water colors and paints—for thickening aqueous dispersions of casein and rubber latex—and as a medium for grinding and dispersing pigments, fillers and other paint materials—are all treated at length in a leaflet prepared by the Dow Chemical Company, Midland, Mich. Interested persons may secure a copy by addressing the Dow Chemical Company.

The Papermaking Properties of Holocellulose*

By Harold H. Houtz [1] and Ervin F. Kurth [2]

Abstract

1. A material approximating holocellulose was prepared by a method adapted from the quantitative procedure developed by VanBeckum and Ritter. A second fraction was obtained by extracting a part of this material with 0.5 per cent solution of ammonium oxalate at 90 deg. C. Chemical analysis indicated that a small amount of the pentosans and polyuronides had been removed. A third fraction was obtained by over-chlorination and hydrolysis during the preparation. Analysis showed that more than half the pentosans had been removed and that the beta-cellulose content had been considerably increased. A fourth fraction was obtained by extracting a part of the third fraction with 17.5 per cent sodium hydroxide. This treatment resulted in a pulp with an alpha-cellulose content comparable to that of commercial alpha pulp. It was low in all hemi-cellulosic materials.

2. These fractions were processed in a laboratory beater. Consideration of the rate of change of freeness indicates that the less-resistant forms of cellulose (beta- and gamma-celluloses), pentosans, and polyuronides have an important influence on hydration.

3. The various physical tests indicated that good fiber-fiber bonding and high initial individual fiber strength were obtained with the first two fractions. Good bonding was also obtained with the third fraction, but the fiber strength had been decreased by degradation of the cellulose or by breaking up of fiber bundles. Fraction 4, which was low in hemicelluloses, was very resistant to beating and developed very poor strength characteristics.

4. The aging of the three fractions high in hemicelluloses was much more rapid than the fraction high in alpha-cellulose. The aging of Fraction 3 was the most rapid.

5. It is believed that this investigation definitely substantiates the chemical theory of beating with the formation of gelatinous hydrate. It is evident that the hemicellulosic materials play an important part in the development of this gelatinous hydrate, although it would be difficult to deduce just which constituent is definitely responsible for this action. The less-resistant cellulosic materials seem to play a very important part in this respect, while the polyuronides and the pentosans also exert a considerable effect. Aging appears to be accelerated by the presence of hemicellulosic materials, the degraded cellulose having the greatest effect.

6. Probably the most important result of this investigation was the production of a pulp which not only could be beaten to a glassine stock in a very short time but also developed some remarkable strength characteristics. The data show the desirability of conducting the cooking process, in the production of pulps to be used for highly hydrated papers, in such a manner that as much as possible of the hemicellulosic materials is retained. More work is necessary to adapt this laboratory procedure to the commercial production of such a pulp, but its commercial use would seem to be indicated, possibly not alone but admixed with other pulps, in the manufacture of highly hydrated papers such as glassine.

Introduction

The characteristics of paper made from a pulp containing all the carbohydrate constituents originally present in the wood substance have long been a matter of interest and conjecture. Many investigators have proposed theories attempting to explain the mechanism of fiber processing. It has been held that the development of strength in pulps is due entirely to physical changes in the fiber surface, to chemical action, or to a combination of these two. In connection with the theory of chemical action, or "hydration," various investigators have suggested that such constituents of the fiber as the pentosans, the polyuronides, and the beta- and gamma-celluloses are mainly responsible for its hydrating capacity.

The purpose of this study was to prepare holocellulose in sufficient quantity to make a laboratory beating test, to prepare various fractions of the holocellulose by removing certain of the constituents and make beating tests on these fractions, and to evaluate the strength of the sheets and their permanence when aged by heat and ultraviolet light. The fractions chosen for investigation were: (1) the holocellulose, (2) the fraction remaining after extraction of the holocellulose with ammonium oxalate, (3) the fraction left after partial hydrolysis of the holocellulose with hydrochloric acid, and (4) the fraction remaining after an alpha-cellulose treatment of the holocellulose.

Preparation of Materials

A sound spruce log, obtained from a lot of commercial pulpwood, was carefully barked and all knots removed. This was then reduced to shavings approximately 0.010 inch thick by means of a carpenter's hand plane. The use of the material in this form was considered necessary in order to secure sufficient penetration of the chlorine gas and, at the same time, to retain the fibers in their original length. The shavings were thoroughly mixed to eliminate variations between different parts of the log and allowed to air-dry.

The holocellulose, hereafter to be designated as Fraction 1, was prepared by the method of VanBeckum and Ritter *(1)* with certain modifications to adapt it to the considerably larger scale methods necessary in this work. The method adopted, after several trials, consisted of soaking a known weight

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of the shavings (approximately a pound) in water, then pressing to a moisture content of 70-80 per cent in a pulp press. The moist shavings were chlorinated in batches of about 50 grams in a large beaker immersed in a water bath at 8-10 deg. C. The chlorine was admitted slowly and the shavings were agitated constantly to keep them cool, otherwise the hydrochloric acid formed by the chlorination of the lignin hydrolyzed a part of the carbohydrates and rendered them soluble. The chlorination was continued for five minutes. It was found that if the chlorinated shavings were washed with water, as is recommended in the procedure of VanBeckum and Ritter, the water could not be removed rapidly enough, owing to the nature of the material, to prevent hydrolysis. They were, therefore, put directly into a 4 per cent solution of monoethanolamine in 95 per cent ethyl alcohol heated practically to boiling. The excess of monoethanolamine served to neutralize the acid not removed by washing. After remaining in the solution for approximately five minutes, the alcohol solution was removed by pressing, and the material was given a second extraction with a hot 3 per cent solution of monoethanolamine in alcohol. After this extraction the material was again pressed to remove the alcohol, washed with cold water until the washings were entirely colorless, and pressed for the second chlorination.

The first three chlorinations and extractions were carried on as already described, but in the following chlorinations it was found possible to chlorinate the whole batch at one time, since the amount of acid formed and the heat generated were not sufficient to cause hydrolysis.

The treatments were continued until the monoethanolamine-alcohol solution remained practically colorless after extraction. Nine chlorinations and extractions were necessary.

Fraction 2 was prepared by extracting a portion of Fraction 1 with a 0.5 per cent solution of ammonium oxalate. The solution was heated to approximately 90 deg. C. before adding the holocellulose and was maintained at this temperature for two hours by means of a boiling water bath. This solvent presumably removes polyuronides *(2)*.

Fraction 3 was prepared by carrying on the initial chlorinations at a more rapid rate and in larger batches than in the case of the holocellulose preparation. No external cooling was provided. The combination of the hydrochloric acid formed by chlorination and the somewhat elevated temperature served to remove the easily hydrolyzable pentosans *(3)*.

Fraction 4 was prepared by treating a portion of Fraction 3 with 17.5 per cent sodium hydroxide for forty-five minutes at 20 deg. C. At the end of this period the pulp was filtered and washed with water. It was then soaked in 10 per cent acetic acid solution, filtered, and washed until it showed no reaction to litmus.

The shavings used throughout the preparation were accurately weighed and a proportionate, composite sample taken for analysis. A moisture determination was made on the composite sample. The remainder of the sample was ground and screened, that passing a 40-mesh and retained on an 80-mesh screen being kept for further analysis. A quantitative alcohol-solubility determination followed by a hot-water solubility determination was made on this material following the procedures of TAPPI Method T 6 m-36 and TAPPI Method T 1 m-34, respectively. The remainder of the 40-80 mesh wood meal was qualitatively extracted with alcohol and hot water, air-dried, and used for further analyses.

The yields of the various fractions were determined by air-drying the pulps after preparation, allowing them to come to equilibrium by storing for several days in an air-tight container, weighing, and determining the moisture content. All yields were based on extractive-free wood.

The analyses of the fractions were made on samples which had been thoroughly disintegrated in a Gösta Hall disintegrator and allowed to condition for at least forty-eight hours in an air-tight container.

The determinations made on each fraction included lignin, pentosans, alpha-, beta-, and gamma-celloluse, and uronic acid anhydride.

The data tabulated in Table I indicate that the theoretical yield of holocellulose from the wood used should be 71.19 per cent. This value is obtained by deducting the lignin content from the yield of extractive-free wood. In addition to containing all of the carbohydrate constituents (cellulose, hemicellulose, pentosans, and polyuronides), spruce holocellulose contains all of the acetyl and formyl groups and that portion of the methoxyl not present in the lignin fraction *(4)*. The yield of Fraction 1 is, therefore, 2 per cent lower than the theoretical.

The lignin remaining in Fraction 1 was mainly in fiber bundles resulting from spots in the shavings which were too thick to be completely penetrated by the chlorine during chlorination.

These lignified fiber bundles were readily broken up by the beater.

The extraction with hot ammonium oxalate solution resulted in the removal of some of the polyuronides and a small amount of the pentosans. The lignin content was determined only qualitatively but gave the same sort of precipitate as Fraction 1.

The over-chlorination used to obtain Fraction 3, hydrolyzed and removed more than half of the pentosans originally present in the wood. Under the hydrolyzing conditions of the treatment, the cellulose was attacked and degraded to some extent. This is apparent from the high value obtained for beta-cellulose.

The extraction of Fraction 3 with 17.5 per cent sodium hydroxide solution resulted in a pulp with an alpha-cellulose content comparable to that of commercial alpha pulp. By this treatment, 91.83 per cent of the pentosans and 71.5 per cent of the polyuronides

TABLE I—COMPOSITION OF EXTRACTIVE-FREE WOOD AND THE VARIOUS FRACTIONS
(Results based on oven-dry weight of extractive-free wood)

Material	Treatment	Yield Per cent	Lignin Per cent	Pentosan Per cent	Alpha-Cellulose Per cent	Beta-Cellulose Per cent	Gamma-Cellulose Per cent	Uronic Acid Anhydride Per cent
Wood	Extracted with alcohol and hot water	100.0	28.81	13.70	....	....	....	3.68
Fraction 1	Chlorination and extraction with alcohol-monoethanolamine	49.2	0.10	8.76	54.5	0.50	12.26	3.06
Fraction 2	Extraction of Fraction 1 with hot 0.5 per cent ammonium oxalate	63.6	....	7.54	49.7	0.43	11.80	2.47
Fraction 3	Over-chlorination and hydrolysis	58.2	....	4.77	45.2	1.93	10.16	2.14
Fraction 4	Extraction with 17.5 per cent NaOH	47.3	....	1.12	43.1	0.25	4.56	1.05

were removed, but a considerable amount of the less-resistant forms of cellulose remained.

Physical Testing

The various fractions were processed in a standard 1.5-pound laboratory beater of the Niagara type. The method followed was that of TAPPI Standard T 200 m-34 with the exception that, in all cases, only 3,600 grams were added to the bedplate lever after balancing. Samples for freeness tests and handsheets were withdrawn at 15-minute intervals except in the case of Fraction 4, in which they were withdrawn at 20-minute intervals after the first sixty-five minutes of beating.

Handsheets were made from the samples taken at the various beating intervals using the British sheet machine (TAPPI Standard T 205 m-36). They were conditioned at 65 per cent relative humidity and 70 deg. F. for at least six hours before running the physical tests. The tests made were selected to give an indication of the development of strength and other characteristics, due to hydration and improved fiber-fiber bonding as well as to individual fiber strength.

They included basis weight, caliper, mullen, fold, tear, and opacity.

The opacity was determined with the Bausch and Lomb Opacimeter. The average of two readings for each sheet was taken as the value for that sheet.

Sheets from the last beating interval were subjected to "blister" tests by holding them over a small flame.

The results of the various physical tests have been assembled in Table II.

The freeness of the three fractions high in non-cellulosic constituents dropped rapidly with beating, in all cases reaching glassine freeness in less than thirty minutes. Fraction 3 beat most readily, Fraction 1 slightly more difficultly, and Fraction 2 the least readily of this group. From a consideration of these data and the fact that Fraction 3 had a somewhat lower content of pentosans and polyuronides and a relatively higher content of beta-cellulose, it would seem that the degradation products of cellulose have some influence in "hydration." This supports the conclusions of Obermanns *(5)*. Also, the fact that Fraction 1, which is higher in both pentosans and polyuronides, hydrates somewhat more readily than Fraction 2 indicates that these constituents are influential in hydration. The behavior of Fraction 4 was probably due to the low content of hemicellulosic constituents and the high purity of the cellulosic constituents, resulting in a resistance to hydration. The drop in freeness was, therefore, due almost entirely to cutting and fibrillation.

TABLE II—PHYSICAL CHARACTERISTICS OF BEATEN FRACTIONS

Fraction	Beating Time min.	Freeness cc. S.R.	Apparent Density	Mullen pts./lb.	Fold	Tearing Strength g.	Opacity Contrast Ratio
1	5	885	7.37	0.419	169	72.8	0.507
	20	406	12.82	1.971	3412	40.0	0.388
	35	133	14.63	1.736	4753	33.4	0.323
	50	64	....	....	....	...	....
2	5	891	6.52	0.403	33	76.3	0.535
	20	518	13.13	2.110	2403	37.8	0.439
	35	204	14.34	1.812	2603	33.4	0.354
	50	128	14.51	1.678	3044	28.8	0.290
	65	59	....	....	....	...	....
3	5	838	11.46	0.670	107	41.6	0.581
	20	285	14.93	1.148	1004	25.8	0.316
	35	86	15.85	1.162	1204	21.3	0.317
	50	46	....	....	....	...	....
4	5	903	....	....	....	...	....
	20	883	6.29	0.166	....	51.5	0.719
	35	863	7.55	0.174	....	49.6	0.738
	50	857	8.69	0.281	4	48.2	0.723
	65	831	9.72	0.372	8	49.1	0.727
	85	717	9.99	0.442	15	45.6	0.718
	105	527	11.27	0.553	39	45.9	0.717
	125	348	12.34	0.663	59	40.0	0.713

The apparent density changed as was to be expected, increasing with the degree of beating. The high value which the apparent density reached in the case of Fraction 4 indicates that cutting and fibrillation also play an important part in sheet formation.

The development of bursting strength with beating was extremely rapid in the case of the first three fractions and, in the case of the first two fractions, reached exceptionally high values. This rapid development of mullen is indicative of the ease of formation of the gelatinous hydrate, with consequent good fiber-fiber bonding. The hydrate also formed readily in the case of Fraction 3, but the individual fiber strength had been impaired by the oxidizing action of the chlorine, resulting in a much lower maximum value. The data show that sufficient bonding was obtained during the early stages of beating to develop the strength of the fibers; further beating merely weakened them by cutting and gelatinization. The development of strength in the case of Fraction 4 was probably due almost entirely to fibrillation. The low values obtained indicate very poor bonding.

The folding strength data again signify the rapid development of fiber-fiber bonds, due to the formation of the gelatinous hydrate. The weakness of the individual fibers in the case of Fraction 3 is also again apparent. The lack of bonding with Fraction 4 may be seen from the fact that, until the fifty-minute beating interval, the sheets did not have sufficient strength to sustain the load on the Schopper fold tester.

The high initial tearing strength of Fractions 1 and 2 denotes a long-fibered pulp with high individual fiber strength. The extremely rapid drop in tearing strength with beating indicates extreme ease of hydration and decrease in individual fiber strength due, possibly, to the breakdown of fiber structure to form the hydrate. In the case of Fraction 3, the fibers have been considerably weakened by degradation, resulting in low initial tear. Hydration is also rapid with this pulp as evidenced by the rapid drop in tearing strength. There is also the possibility that the long fibrous structure of Fractions 1 and 2 denotes series of fibers or fiber strands which are held together by the carbohydrate gel adhesive before gelatinization. These may pull apart as hydration proceeds, causing a decrease in tearing strength. The removal of this material by the hydrolysis in the case of Fraction 3 results in a low initial tearing strength. The slow drop in tearing strength with Fraction 4 indicates resistance to the formation of gelatinous hydrate.

As might be expected from the freeness, sheets from Fraction 3 have the lowest opacity, Fraction 1 slightly higher, and Fraction 2 the highest of this group. This may be explained by the elimination of air-fiber interfaces in the sheet by the cellulose hydrate, with the formation of a more optically homogeneous system. Since hydration was practically absent in the beating of Fraction 4, the opacity would be expected to be high and remain so during beating. This was found to be true.

Accelerated Aging Tests

Handsheets made from the samples taken after twenty minutes' beating were used for the accelerated aging tests. The heat aging test was carried out ac-

cording to the Bureau of Standards' method *(6)* of heating at 100 deg. C. for seventy-two hours. The effects of aging were followed by determining the brightness with a General Electric reflection meter. Values were determined at intervals during the run to obtain an idea of the rate of aging.

Light aging was carried out with a fadeometer using ultraviolet light from a carbon arc. Brightness values were determined at various time intervals to obtain the rate of aging.

Results of the accelerated aging tests are tabulated in Tables III and IV.

It was found, in the case of ultraviolet light aging, that Fraction 3 aged at a slightly faster rate during the initial stages than the other fractions higher in hemicellulosic constituents, and that all these fractions aged at a considerably faster rate than Fraction 4 which was high in alpha-cellulose.

TABLE III—RESULTS OF ULTRAVIOLET LIGHT AGING

Time of Aging hours	Brightness			
	Fraction 1	Fraction 2	Fraction 3	Fraction 4
0	48.6	52.7	51.9	76.6
1	44.7	49.5	47.8	74.1
2	43.1	48.2	46.2	73.5
3	43.0	47.7	45.6	73.3
5	42.4	47.8	45.6	73.2
7	42.4	47.4	45.3	73.1
Total Drop	6.2	5.3	6.6	3.5

TABLE IV—RESULTS OF HEAT AGING

Time of Aging hours	Brightness			
	Fraction 1	Fraction 2	Fraction 3	Fraction 4
0	47.7	53.4	50.7	77.6
2	44.4	50.5	46.0	75.0
14	41.2	47.3	41.3	71.8
41	37.8	44.7	36.7	69.4
72	34.7	42.0	34.2	67.7
Total Drop	13.0	11.4	16.5	9.9

The same general relation was found in the case of heat aging, except that Fraction 3 aged at a much faster rate than the others. This would indicate that the degraded cellulosic materials were responsible to a large extent for the degradation resulting from heat aging.

The sheets from the final beating interval gave good blister tests in the case of the first three fractions, indicating a high resistance to moisture penetration.

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(1) VanBeckum, W. G., and Ritter, G. J., *Paper Trade J.* 104, no. 19: 49-50 (May 13, 1937).
(2) Hawley, L. F., and Wise, L. E., "The Chemistry of Wood," p. 41. New York, Chemical Catalog Company, 1926.
(3) Bray, M. W., and Andrews, T. M., *Paper Trade J.* 76, no. 19: 49-51 (May 10, 1923).
(4) Kurth, E. F., and Ritter, G. J., *J. Am. Chem. Soc.* 56: 2720-2723 (1934).
(5) Obermanns, H. E., *Paper Trade J.* 103, no. 7: 83-91 (Aug. 13, 1926).
(6) Rasch, R. H., *Bur. Standards J. Research* 3: 469-506 (1929).

Review Of Paper Industry Literature

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C. for 10 cents each. Send currency, not stamps.

Sizing

Paper Sizing. Judson A. De Cew. U. S. pat. 2,137,239 (Nov. 22, 1938).—A sizing solution containing approximately 3 per cent of ammonium resinate is made directly by mixing together at about 100 deg. F. 100 parts of water and 3 parts of pulverized rosin in the presence of sufficient ammonia to saponify the rosin.—A.P.-C.

Paper Manufacture with Incorporation of Starch. Donald K. Pattiloch, assignor to Pattiloch Processes, Inc. U. S. pat. 2,147,213 (Feb. 14, 1939).—Gelatinized starch is mixed with paper fibers to form a starch-containing furnish. The furnish is diluted to substantially paper-making consistency, alum is added while the furnish is flowing in a stream, followed by a sufficient amount of sodium aluminate, sodium metasilicate or sodium sesquisilicate to form an aluminous precipitate by the substantially complete reaction of both added ingredients in the furnish but keeping the furnish acid. The starch is precipitated upon the fibers, and a paper web is formed therefrom.—A.P.-C.

Method for Sizing Photographic Paper. John C. Trahey, assignor to Eastman Kodak Company. U. S. pat. 2,143,809 (Jan. 10, 1939).—A predetermined proportion of the air in the interstices of the paper is removed by submitting it to a blast of steam tempered with a controlled quantity of air which has been heated to about the same temperature, and the paper is immersed immediately in a sizing bath. An apparatus is specified.—A.P.-C.

Sizing of Paper. Kodak, Ltd. Brit. pat. 488,917 (Feb. 14, 1938).—Paper is subjected to the action of a mixture of steam and hot air before passing to a size bath. The amount of size taken up by the paper depends on the amount of air in the sheet; thus the sizing degree is controlled by adjusting the steam-air ratio. An apparatus is described and claimed.—A.P.-C.

Sizing Paper. Penick & Ford, Ltd., Inc. Brit. pat. 485,700 (March 9, 1937).—Starch for sizing purposes is heated in water to a point at which maximum swelling occurs without disruption of the granules. Subsequent gelatinization occurs at the drying cylinders. The initial swelling of the starch is controlled by addition of inhibiting agents, such as soaps, sulphonated vegetable oils, etc., to the aqueous suspension, and the final gelatinization during drying of the paper may be aided by the presence of alum, which renders the inhibiting agents insoluble.—A.P.-C.

Process for Sizing Paper, Especially Photographic Paper. Kodak-Pathé, Soc. Anon. Française. Belg. pat. 427,195 (April 30, 1938).—The paper is treated with a mixture of condensible (steam) and uncondensible (air) gases, and is then immersed directly into the sizing bath.—A.P.-C.

Rosins and Rosin Acid Derivatives, Etc. Edwin R. Littmann, assignor to Hercules Powder Company. U. S. pat. 2,137,576 (Nov. 22, 1938).—Products which form salts for sizing paper, etc., have the formula $R\text{-}CO_2H$ in which R is the hydro-carbon nucleus of an acid from the group consisting of rosin, rosin acids, partially hydrogenated rosins, and partially hydrogenated rosin acids, which has been treated with a hydrogenation catalyst in the absence of any added substance capable of reducing the unsaturation of the hydrocarbon nucleus under the conditions of treatment, the compound being characterized by the fact that it has a lower degree of unsaturation

than that of a similar compound in which R is untreated may, for instance, be obtained by the use of abietyl or sapinyl alcohol as initial material, with palladium black on granular alumina as catalyst.—A.P.-C.

Protein Material Suitable for Use in Coating Paper. Philip Rauer and Paul Torrington, Jr., assignors to Soysein Process Corporation. U. S. pat. 2,132,434 (Oct. 11, 1938).—Protein material is dissolved from a vegetable meal such as soybean meal (suitably in a dilute sodium sulphite solution containing sodium hypochlorite) and the protein-containing solution is separated, the protein is precipitated by acid treatment (as by the use of hydrochloric and sulphuric acids), and the precipitate is brought to the condition of a plastic mass. An alkali metal sulphite is added, and the material is preserved in plastic condition or paste form for shipment and use in coating paper.—A.P.-C.

Size and Method of Making It. Arthur C. Dreshfield and Henry A. Johnstone, assignors to Hercules Powder Co. U. S. pats. 2,134,911 and 2,134,912 (Nov. 1, 1938).—A dry porous and readily soluble rosin size is produced by introducing rosin and saponifying materials under pressure in a closed reaction chamber, applying heat and pressure to produce within the chamber a temperature of about 275 deg. to 375 deg. F. and a pressure of 100 to 125 lb., and discharging the saponified material by the pressure in the reaction chamber into a flash chamber, in which a cooling atmosphere is maintained at a lower temperature and pressure and at a relative humidity not in excess of about 78%. The moisture content of the saponified material is so diminished that a dry size results, which contains not more than 5 per cent water and is in the form of discrete porous particles. **No. 2,134,911** covers the process and **No. 2,134,912** the product obtained thereby.—A.P.-C.

Coating

Method of Preparing a Starch Enveloped Mineral Material. Harold T. Ruff, assignor to The Mead Corp. U. S. pat. 2,140,394 (Dec. 13, 1938).—An aqueous starch-granule slurry is stirred with added mineral matter such as calcium carbonate, and the resulting intimate mixture is heated to cause bursting of the starch granules and coating of the mineral particles with a film of the liberated starch and suspension of the starch-coated particles.—A.P.-C.

Thermoplastic, Pressure-Sensitive Compositions Suitable for Removable Coatings on Paper. Allen Abrams and George W. Forcey, assignors to Marathon Paper Mills Company. U. S. pat. 2,142,039 (Dec. 27, 1938).—A normally removable and reusable adhesive sheet material suitable for masking-tapes, etc., comprises a cohesive agent such as 15 to 60 per cent of rubber, 10 to 50 per cent of an adhesive agent such as isobutylene polymer, 5 to 45 per cent of a non-volatile plasticizer such as a wax, and 4 to 45 per cent of a modifier such as methyl abietate. Numerous other examples are given.—A.P.-C.

Laminated Sheet Material for Wrapping Bread, Etc. Adrian O. Daller, assignor to Utility Packages, Inc. U. S. pat. 2,143,844 (Jan. 17, 1939).—A laminated wrapping material comprises a strip of paper coated with a wax-like film, a flexible strip of transparent cellulosic material such as cellophane provided with a moistureproof coating, and an adhesive derived from latex securing the overlapping strips together (the use of the various modifying agents with the adhesive being described.)—A.P.-C.

Improved Process and Device for Glazing Coated Paper. Establissements Brepols, Soc. Anon. Belg. pat. 429,446 (Aug. 31, 1939).—The powder formed during flint glazing is removed from the surface of the paper by means of a pad mounted on the rocking shaft of the machine and pressing on the paper while following a path similar to that of the flint.—A.P.-C.

Coating and (or) Impregnating Paper and the Like. E. I. Du Pont de Nemours & Co., J. K. Hunt and G. H. Latham. Brit. pat. 491,317 (Feb. 25, 1937).—A felted or woven fibrous base material is coated and (or) impregnated with a composition containing a cellulose mixed ester having one alkyl substituent with less than 3 carbon atoms and the other with 8 to 18 carbon atoms per alkyl group. This composition may be applied as a lacquer, in organic solvent as hot melt, in aqueous emulsion, or in pre-cast sheets. The paper is improved in appearance or feel and becomes more resistant to grease, water vapor, or liquid water, and is more transparent.—A.P.-C.

Production of Fibrous Porous Materials. British Celanese, Ltd. Brit. pat. 489,468 (Oct. 27, 1937).—A base material, such as paper, is coated with a cellulose ester or ether composition containing also solid particles (1/32 to ¼ in. in diameter) of a soluble material (e.g., sodium chloride, sodium sulphate potassium carbonate); or substances which will evolve a gas (e.g., a carbonate). The composite product is then treated to produce porous coatings, e.g., by application of water to dissolve out the solid particles, or heat or acid to effect gas evolution; products coated with cellulose esters may subsequently be saponified. Fillers, plasticizers, pigments, etc., may be present in the coatings. The products have good insulating capacity of sound, heat and electricity.—A.P.-C.

Method of and Apparatus for Coating Paper. Donald R. Macdonald. U. S. pat. 2,135,406 (Nov. 1, 1938).—In a coating apparatus in which even distribution of the coating material on the paper is effected by means of a narrow jet of compressed air impinging aaginst the sheet, an auxiliary air jet is provided under the bottom of the box from which the main air jet emerges, in order to prevent accumulation thereon of entrained coating material.—A.P.-C.

Coating Absorbent Materials Such as Paper with Resin. George C. Tyce and Victor Lefebure, assignors to Imperial Chemical Industries Ltd. U. S. pat. 2,125,527 (Aug. 2, 1938.)—For producing a coated paper with a glossy surface, the paper is treated with a dispersion of solid resins in a dispersing medium such as water in which the resins are insoluble, and the paper is subjected to a temperature between the boiling point of the dispersing medium and the melting point of the resin until the resin has formed a continuous film on the surface of the paper. The latter is dried at a lower temperature and then passed between hot rolls.—A.P.-C.

Imports of Paper and Paper Stock

Giving Manifests of New York, Boston, Philadelphia and Other Ports of Newsprint, Wrapping, Writing, Coated, Blotting, Tissue, Strawboard, Wallboard, Cigarette Papers, Sulphite, Kraft and Ground Wood Pulp.

NEW YORK IMPORTS

WEEK ENDING DECEMBER 9, 1939

SUMMARY

Paper hangings .....9 bls., 1 cs.
Newsprint .....2,394 rolls
Printing paper.....384 rolls, 96 cs.
Wrapping paper .....130 pkgs., 4 bls.
Packing paper .....52 bls.
Paper bags .....35 cs.
Surface coated paper .....217 rolls, 6 cs.
Basic paper .....197 rolls, 24 cs.
Basic board .....10 rolls
Decalcomanias ..... 35 cs.
Cardboard .....17 rolls, 32 cs.
Transparent paper .....4 cs.

PAPER HANGINGS

W. H. S. Lloyd & Co., ——, London, 1 cs., 9 bls.

NEWSPRINT

Jay Madden Corp., ——, Kotka, 1,432 rolls.
H. Reeve Angel & Co., Inc., ——, Kotka, 605 rolls.
Walker Goulard Plehn Co., ——, Kotka, 154 rolls.
Nolan Bowmall & Co., Inc., ——, Gothenburg, 145 rolls.
Parsons & Whittemore, Inc., ——, Gothenburg, 58 rolls.

PRINTING PAPER

General Motors Overseas Operations, *Rotterdam,* Rotterdam, 204 rolls, 18 cs.
F. C. Strype, *Statendam,* Rotterdam, 78 cs., 180 rolls.

WRAPPING PAPER

——, ——, Gothenburg, 130 pkgs., 4 bls.

PACKING PAPER

Grace Line, ——, Gothenburg, 52 bls.

PAPER BAGS

Irving Trust Co., *Vulcania,* Genoa, 35 cs.

SURFACE COATED PAPER

P. C. Zuhlke, *Rotterdam,* Rotterdam, 6 cs.
General Motors Overseas Operations, *Rotterdam,* Rotterdam, 217 rolls.

BASIC PAPER

General Motors Overseas Operations, *Rotterdam,* Rotterdam, 197 rolls, 24 cs.

BASIC BOARD

——, *Statendam,* Rotterdam, 10 rolls.

DECALCOMANIAS

General Motors Overseas Operations, *Rotterdam,* ——, 35 cs.

CARDBOARD

R. Wilson Paper Corp., *Statendam,* Rotterdam, 32 cs., 17 rolls.

TRANSPARENT PAPER

M. J. Corbett & Co., *Rotterdam,* Rotterdam, 4 cs.

RAGS, BAGGINGS, ETC.

Castle & Overton, Inc., *Montevideo,* Buenos Aires, 113 bls. bagging.
Hughes Fawcett, Inc., *Breedyk,* Rotterdam, 73 bls. rayon waste.
E. J. Keller Co., Inc., *Statendam,* ——, 150 bls. rags.
G. W. Millar & Co., Inc., *Statendam,* Rotterdam, 86 bls. rags.

BONE GLUE SHEETS

Transatlantic Animal By Products, *Carlo Martinolich,* Trieste, 100 bags.

CASEIN

Chase National Bank, *Rotterdam,* Rotterdam, 443 bags.
Balfour Guthrie & Co., *Montevideo,* Buenos Aires, 847 bags, 50,820 kilos.

WOOD PULP

Pulp Sales Corp., ——, Kotka, 2,016 bls. moist mechanical pulp, 406 tons.
M. Sone, ——, Gothenburg, 300 bls. wood pulp.

WOOD PULP BOARDS

H. Fuchs & Son, ——, Gothenburg, 73 cases, 117 crates.

ALBANY IMPORTS

WEEK ENDING DECEMBER 9, 1939

Price & Pierce, Ltd., *Virginia,* ——, bleached sulphate, 50 tons.

PORTLAND IMPORTS

WEEK ENDING DECEMBER 9, 1939

M. Sone, *Hammaren,* Gothenburg, 2,053 bls. wood pulp.

BOSTON IMPORTS

WEEK ENDING DECEMBER 9, 1939

M. Sone, *Hammaren,* Gothenburg, 600 bls. wood pulp.

PHILADELPHIA IMPORTS

WEEK ENDING DECEMBER 9, 1939

——, *Anita,* Buenos Aires, 167 bags casein, 10,020 kilos.

BALTIMORE IMPORTS

WEEK ENDING DECEMBER 9, 1939

M. Sone, *Vingaren,* Gothenburg, 1,994 bls. wood pulp.
Pagel Horton & Co., Inc., *Heimvard,* Sweden, 14,500 bls. wood pulp.

LOS ANGELES IMPORTS

WEEK ENDING DECEMBER 9, 1939

——, *Keisho Maru,* Kobe, 370 bls. bagging.
——, *Keisho Maru,* Osaka, 20 bls. rags.
——, *Keisho Maru,* Yokohama, 18 bls. rags, 1 cs. paper, 1 cs. writing paper.
——, *Rosebank,* Vancouver, 177 bls. bagging.
——, *Rosebank,* Powell River, 933 pkgs. newsprint.
——, *Josephine Lawrence,* Ocean Falls, 2343 rolls newsprint.
——, *Laurits Sweseon,* Oslo, 108 rolls newsprint.

Tacoma Mill Resumes Operations

The Tacoma Division of Rayonier Inc., at Tacoma, Wash., resumed operations on December 1, after having been closed down for an extended period. A number of improvements in equipment, including the installation of a new chipper, were made. The mill will operate at full capacity, due to a general improvement in business conditions, notably in the rayon and cellophane industries.

Try New Industrial Survey

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 13, 1939—Questionnaires are being sent to a number of paper manufacturers by the Department of Commerce in a new industrial survey which is being tried out.

Commerce Department is sending out about 2,000 of these industrial survey questionnaires to the major industries. Whether this service will go ahead depends entirely on the answers received by the department.

The questionnaires ask for information for June, October, and November of this year and November of last year. Information requested includes the net sales for the month; new orders received during the month; unfilled orders at the end of the month; and the value of inventories at the end of the month. In this latter question are included subdivisions, such as raw materials, goods in process, finished goods, and fuel and shop supplies.

In explanation of net sales, the department explains that by net sales is meant invoiced shipments less discounts, returns, allowances, excise taxes and other deductions.

It is reported here that the decision to undertake this work was made after the Business Advisory Council of the Department of Commerce, and other leading industrialists and business men, had indicated the need for this information.

It is said that the questionnaire itself has had the approval of the Business Advisory Council and other business leaders, and it is reported that because of the great importance to business men themselves of having this information, it was generally agreed that they would be willing to cooperate voluntarily in replying to a questionnaire of this type.

Container Men Plead Not Guilty

The National Container Association of Chicago, twelve regional container associations, twenty-six corporations and twenty-five individuals pleaded not guilty to an indictment charging violation of the Sherman anti-trust law in the Federal court in New York on Thursday of last week.

The indictment charges that they conspired to restrain interstate commerce in corrugated and solid fiber board shipping containers by suppressing competition, by fixing non-competitive prices and maintaining those prices and by controlling and limiting production.

Judge Murray Hulbert released each of the individuals, most of them officers of the corporate defendants, in bail of $1,000 and put the case on the calendar for February 5, 1940, when a trial date will be fixed.

Germany Releases Wood Pulp

The Association of American Wood Pulp Importers were informed by the State Department on December 13 that Germany had released two steamers loaded with Swedish wood pulp consigned to dealers in this country. This is considered most encouraging and an indication of the success of the non-re-export affidavit clearance method devised by the cooperative efforts of the German Consul, the State Department, and the Association of American Wood Pulp Importers, which has just been put in effect to expedite shipments of wood pulp from Scandinavian countries.

Johannes Westergaard Elected

At the annual meeting of the Association of American Wood Pulp Importers, held at the Hotel Waldorf-Astoria, New York, on December 7, Johannes Westergaard, vice-president of Atterbury Brothers, Inc., was elected president. Mr. Westergaard succeeds Carlton B. Overton of Castle & Overton, Inc.,

JOHANNES WESTERGAARD

who was elected a director. Per Sparre of the Cellulose Sales Corporation, was elected vice-president, and William Roach, of Atterbury Brothers, Inc., was elected secretary. J. A. Millar of the Perkins-Goodwin Company was re-elected treasurer for the eleventh year. The association presented Mr. Overton with a set of pictures drawn by famous artists and a silver plate suitably inscribed.

November Newsprint Statistics

Production of newsprint in Canada during November 1939 amounted to 288,726 tons and shipments to 287,869 tons, according to the News Print Service Bureau. Production in the United States was 78,886 tons and shipments 81,410 tons, making a total United States and Canadian news print production of 367,612 tons and shipments of 369,279 tons. During November, 30,359 tons of news print were made in Newfoundland, so that the total North American production for the month amounted to 397,971 tons. Total production in November 1938 was 353,329 tons.

The Canadian mills produced 213,783 tons more in the first eleven months of 1939 than in the first eleven months of 1938, which was an increase of eight and nine tenths per cent. The output in the United States was 117,406 tons or fifteen and eight tenths per cent more than in the first eleven months of 1938, in Newfoundland 40,079 tons or sixteen and six tenths per cent more, making a total increase of 371,268 tons, or ten and nine tenths per cent.

Stocks of news print paper at the end of November were 193,466 tons at Canadian mills and 13,399 tons at United States mills, making a combined total of 206,865 tons compared with 208,532 tons on October 31, 1939.

Latest Review of Paper and Pulp Markets

Sales Volume Continues At Good Level For Many Grades of Paper and Paper Products — All Grades of Pulp Firm With Unbleached Sulphite Rather Scarce—Rope Prices Rise—Paper Stocks Steady—Shavings Up.

Office of the PAPER TRADE JOURNAL,
Wednesday, December 13, 1939.

Sales volume in many grades of paper is being well maintained at a high level, though reports from many manufacturers, representatives, jobbers, and general paper merchants, indicate the expected seasonal leveling off prior to the Christmas shopping period and inventory taking the first of the year.

Some slackening in industry was noted last week and, according to the chief source of information, paper production declined some 5 points. The Federal Reserve Board index, based on 1923-1925 as 100, reached 125 in November, which was the peak of production in 1929, reached in June of that year. As this index is not adjusted for increase in population and plant capacity, it must fail to indicate a close comparison and a further rise in the index will be required to indicate equality with the year 1929. As the increase in population during the last ten years has been reported at the rate of 6.50 per cent, the Reserve Index must rise to 133 for production to equal the highest all-time record reached ten years ago.

It may be noted that, while production is now near the 1929 record, which was reported as totaling $50,000,000,000, the value today is about 20 per cent less due to the lower price level prevailing today. In general, current wholesale prices are over 25 per cent less than in 1929.

The index of general business activity declined slightly to 105.7 per cent for the week ended December 2, including paper production, from 105.8 for the preceding week, compared with 93.1 per cent for the corresponding week last year.

Paper production for 166 reporting mills declined to an estimated 92.5 per cent for the week ended December 2, compared with 78.8 per cent for the corresponding period in 1938, with 61.0 per cent for 1937, and with 90.3 per cent in 1936.

Paper board production for the week ended December 2 was 78.0 per cent, compared with 61.0 per cent for the like period in 1938, with 50.0 per cent in 1937, and with 78.0 per cent in 1936.

No important change in the newsprint situation has been reported during the current week, New York imports of newsprint for the week ended December 2, totaled 1,424 rolls, compared with 3,617 rolls reported for the previous week.

Sales of many grades of paper continue to be reported in the New York area as well maintained and up to general trade expectations. Groundwood papers, tissues, most sulphite grades, and kraft papers are reported in active demand.

Paper board is reported at a high level but demand is less active as the peak of the season for shipments of folding boxes had been reached some weeks ago. Demand for paper board specialties continues to be reported as active and prospects for the early months of 1940 are considered excellent.

Mechanical Pulp

The demand for mechanical pulp continues at a high level. Prices are firm and continue unchanged at prevailing market quotations.

Chemical Pulp

Prime grades of chemical pulp continue in active demand and prices are reported as firm. High quality unbleached sulphite pulp is still reported as rather scarce. Strong unbleached sulphite is currently quoted at 2.20 to 2.40. No other important change in prices has been reported this week.

Old Rope and Bagging

Demand for old rope is reported a little more active and the market is very firm, the stronger tone being in part due to the difficulty of obtaining supplies in England and Scotland. Shipments are now prohibited from some foreign ports. Foreign and domestic Manila rope is currently quoted at from 4.25 to 4.50.

No important change has been reported in old bagging this week and prices are unchanged.

Rags

Trading in old and new rags is steady and at about the same level as for several weeks past. Exports have been greatly curtailed by the difficulty in getting cargo space. No important changes have been reported in any grade of rags this week, except on new white No. 1 Shirt cuttings which are currently quoted at from 7.50 to 7.75.

Old Waste Paper

Trading continues steady in most grades of old waste paper. Prices remain unchanged, with the exception of soft white No. 1 shavings, which are higher this week and currently quoted at from 1.80 to 1.90.

Twine

No important change has been reported in the twine market for the current week. Prices are firm and the business outlook is considered in the trade as bright.

E. Haegler Returns to Brazil

E. Haegler, recently appointed Brazilian representative for Rayonier Inc., returned to Rio De Janeiro after a two-month visit to this country, part of which time he spent at the Rayonier mills in Washington.

Mr. Haegler made both trips by plane and will have covered approximately 30,000 miles by air upon his arrival in Rio.

A native of Switzerland, Mr. Haegler has lived in Brazil for many years. The head office of E. Haegler & Co., Ltd. is in Rio De Janeiro, with a branch office in Sao Paulo.

Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, December 13, 1939.

BLANC FIXE—Quotations on blanc fixe are reported firm under a good demand. The pulp is currently quoted at from $42.50 to $45 per ton, in bulk; the powder is quoted at from 3½ to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER—Prices on bleaching powder are firm under a good demand, with prices unchanged at prevailing market quotations. Bleaching powder is currently quoted at from $2 to $2.85 per 100 pounds, in drums, at works.

CASEIN—Quotations on casein are a little lower for the current week. Standard domestic casein, 20-30 mesh, is currently quoted at 17½ cents per pound; 80-100 mesh, at 18 cents per pound. All prices in bags, car lots. Argentine casein is currently offered at 14 cents per pound. Quotations on French casein, at from 14 to 14½ cents per pound, are nominal.

CAUSTIC SODA—Prices on caustic soda are firm under a good demand. Solid caustic soda is currently quoted at from $2.30 to $2.40 per 100 pounds; flake and ground at from $2.70 to $2.95 per 100 pounds, in drums, at works.

CHINA CLAY—Quotations on china clay continue firm under a good demand. Domestic filler clay is currently quoted at from $7 to $15 per ton; coating clay at from $11 to $22 per ton, at mines. Imported clay is offered at from $13.50 to $25 per ton, ship side.

CHLORINE—Prices on chlorine continue firm under a fairly active demand, at prevailing market quotations. Chlorine is currently quoted at $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market is reported as fairly firm for the week, with prices on some grades a little lower. "G" gum rosin is currently quoted at $5.15 per 280 pounds, gross weight, in barrels, at Savannah. "FF" wood rosin is quoted at $5 per 280 pounds, gross weight, in barrels, New York. Seventy per cent gum rosin size is offered at $2.80 per 100 pounds, f.o.b., shipping point.

SALT CAKE—Prices on salt cake are reported as very firm and practically nominal under a heavy demand. Current quotations range at from $15 to $19 per ton; chrome salt cake at from $15 to $16 per ton, f.o.b., shipping point. Prices on imported salt cake are nominal.

SODA ASH—Quotations on soda ash are firm under a good demand and conform to prevailing market prices. Quotations on soda ash in car lots, at works, per 100 pounds, are as follows: in bulk, $.90; in bags, $1.10; and in barrels, $1.35.

STARCH—Quotations on corn starch are reported a little higher for the current week. Globe pearl is quoted at $2.45 per 100 pounds; special paper starch at $2.55 per 100 pounds; all prices in bags, f.o.b., Chicago.

SULPHATE OF ALUMINA—Prices on sulphate of alumina are firm under a steady demand. The commercial grades are currently quoted at $1.15; iron free at $1.45, per 100 pounds, in bags, car lots, f.o.b., works.

SULPHUR—Quotations on sulphur are firm under a good demand and conform to prevailing market levels. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby car lots are offered at $19 per ton.

TALC—Prices on talc are reported as firm and unchanged at prevailing market quotations. Domestic talc is currently quoted at from $15 to $18 per ton, Eastern mines. Imported talc is offered at from $23 to $45 per ton.

Market Quotations

Paper

(Delivered New York)

News, per ton—			
Roll, contract	$50.00	@	—
Sheets	58.00	"	—
Kraft—per cwt.—Delivered Zone A			
Northern, Extra Quality	$4.87½	@	$5.50
Superstandard	4.50	"	5.00
Northern Standard Wrapping	4.25	"	4.50
Standard Wrapping	4.00	"	—
Tissues—Per Ream—Carlots			
White No. 1	.87½	@	—
White No. 1 M. G.	.85	"	—
White No. 1½	.70	"	—
White No. 2	.65	"	—
Anti-Tarnish M. G.	.75	"	—
Colored	.80	"	—
Kraft	.75	"	—
Manila	.65	"	—
Unbl. Toilet, 1 M.	3.50	"	—
Bleached Toilet	5.26	"	—
Paper Towels, Per Case—			
Unbleached, Jr.	1.85	@	—
Bleached, Jr.	3.20	"	—
Manila—per cwt.—C. l. f. a.			
No. 1 Jute	8.25	@	10.25
No. 1 Manila Wrapping, 35 lb.	5.25	"	—
No. 2 Manila Wrapping, 35 lb.	5.00	"	—
Boards, per ton—			
News	45.00	@	—
Chip	45.00	"	—
Sgl. Mla. Lt. Chip	57.50	"	—
Jute Lined Chip	57.50	"	—
White Pat. Coated	70.00	"	—
Kraft Liners	55.00	"	—
Binders Boards	76.00	"	87.00

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds		Ledgers		
100% Rag Ext. No. 1	$39.10	@ $46.00	$40.25	@	$47.25
100% Rag	31.05	" 36.50	32.20	"	37.75
85% Rag	....	"	29.90	"	35.00
75% Rag	23.60	" 27.75	24.75	"	29.00
65% Rag	....	"	21.65	"	26.25
50% Rag	17.55	" 21.50	18.70	"	22.75
25% Rag	14.65	" 17.75	15.80	"	19.25

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds		Ledgers		
No. 1	$8.95	@ $11.00	$10.10	@	$12.25
No. 2	8.05	" 9.75	9.25	"	11.25
No. 3	7.60	" 9.25	8.50	"	10.75
No. 4	7.30	" 9.00	8.50	"	10.25

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper, Delivered in Zone 1:

No. 1 Glossy Coated	$11.90	@	$13.50
No. 2 Glossy Coated	10.35	"	11.75
No. 3 Glossy Coated	9.55	"	11.00
No. 4 Glossy Coated	9.15	"	10.50
No. 1 Antique (watermarked)	8.35	"	9.50
No. 2 Offset	7.70	"	9.00
A Grade E. F.	7.50	"	8.75
A Grade S. & S. C.	7.75	"	9.00
B Grade E. F.	6.95	"	8.00
B Grade S. & S. C.	7.20	"	8.25
C Grade E. F.	6.65	"	7.75
C Grade S. & S. C.	6.90	"	8.00
D Grade E. F.	6.40	"	7.50
D Grade S. & S. C.	6.65	"	7.75

Ivory & India at $.50 cwt. extra.

Mechanical Pulp

(On Dock, Atlantic Ports)

No. 1 Imported—			
Moist	$34.00	@	36.00
Dry	34.00	"	36.00
(Delivered)			
No. 1 Domestic and Canadian	40.00	@	42.00

Chemical Pulp

(On Dock, Atlantic, Gulf and West Coast Ports)

Bleached Sulphite (Domestic and Foreign)—			
Prime Bleached Sulphite	3.00	@	3.25
Prime Qualities—			
Easy-Bleaching Sulphite	2.30	"	2.50
Strong Unbleached Sulphite	2.20	"	2.40
(On Dock, Atlantic Ports)			
Kraft Bleached	3.00	@	3.25
Kraft Light & Strong	1.65	"	1.80
Kraft No. 1	1.60	"	1.75
(F. o. b. Pulp Mill)			
Kraft Domestic	1.60	"	2.12½
(Delivered)			
Soda Bleached	2.90	"	—

Add 60 cents per short ton, dock charges for Albany; $2.50 for Lake Ports East and $3.50 for Lake Ports West of Mackinac Straits. Also add extra freight charges and war insurance to all quotations on imported pulp.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1.	7.50	@	7.75
Silesias No. 1	5.25	"	5.50
New Unbleached	7.75	"	8.00
Blue Overall	5.50	"	5.75
Fancy	2.50	"	3.00
Washables	2.15	"	2.25
Mixed Khaki Cuttings	2.75	"	3.00
O. D. Khaki Cuttings	3.00	"	3.25

Old Rags

White, No. 1—			
Repacked	3.50	"	4.00
Miscellaneous	3.00	"	3.25
White, No. 2—			
Repacked	1.25	"	2.75
Miscellaneous	1.75	"	1.90
Thirds and Blues—			
Repacked	2.00	"	2.25
Miscellaneous	1.75	"	1.90
Roofing Rags—			
No. 1	1.70	"	1.80
No. 2	1.25	"	1.30
No. 3 (bagging)	1.50	"	1.60
No. 4	.60	"	.65
No. 5A	.60	"	.65

Foreign Rags

All prices nominal.

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	"	2.20
New Light Silesias	5.50	"	5.75
Light Flannelettes	5.50	"	5.75
New White Cuttings	7.00	"	7.50
New Light Oxford	4.00	"	4.50
New Light Prints	3.00	"	3.25

Old Rags

No. 1 White Linens	7.50	"	8.50
No. 2 White Linens	6.50	"	7.50
No. 3 White Linens	4.50	"	—

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ENGLISH FINISH SUPERCALENDERED
MACHINE FINISHED BOOK
and LITHOGRAPHIC PAPERS

Offset, Envelope, Bond, Writing, Mimeograph, Ledger, Eggshell, Cover and Music Papers, Index Bristol, Post Card and Label Papers

HIGH GRADE COATED BOOK

• • • •

KRAFT WRAPPING AND KRAFT ENVELOPE
KRAFT LINER BOARD
BLEACHED SULPHITE AND SODA PULP
BLEACHED AND UNBLEACHED KRAFT PULP

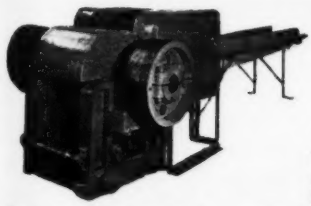
MILLS:

Mechanicville, New York
Luke, Maryland
Covington, Virginia
Tyrone, Pennsylvania
Williamsburg, Pennsylvania
Cass, West Virginia
Charleston, South Carolina

SCREENS of Perforated Metal

The Harrington & King PERFORATING CO.

5652 Fillmore St., Chicago, Ill. 114 Liberty St., New York, N.Y.



CUTS 3 TO 4 TONS OF RAGS AN HOUR

This modern streamlined cutter has every feature for greater efficiency in low cost production.

NO. II "GIANT" MULTIPLEX RAG CUTTER
will reduce 3 to 4 tons of rags an hour. Other models, to take care of any type of cutting.

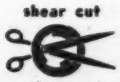
TAYLOR-STILES & COMPANY

10 Bridge Street Riegelsville, N. J.

LANGSTON SLITTERS AND ROLL WINDERS

Incorporate the best slitting and winding principles, — Shear Cut, and Surface or Drum Winding.

shear cut



clean cut

SAMUEL M. LANGSTON COMPANY

CAMDEN, N. J.

No. 4 White Linens.	2.25	@	3.25
No. 1 White Cotton.	4.25	"	4.75
No. 2 White Cotton.	3.25	"	3.75
No. 3 White Cotton.	2.50	"	3.00
No. 4 White Cotton.	1.90	"	2.20
Extra Light Prints..	2.00	"	2.40
Ord. Light Prints...	1.75	"	2.15
Med. Light Prints...	1.55	"	1.95
Dutch Blue Cottons.	2.25	"	2.50
French Blue Linens..	3.00	"	—
Checks and Blues...	2.00	"	—
Linsey Garments....	1.90	"	2.00
Dark Cottons.....	1.50	"	1.60
Old Shopperies.....	1.30	"	1.45
New Shopperies.....	1.45	"	1.50
French Blues.....	2.25	"	2.50

Old Rope and Bagging

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	2.50	@	2.75
Domestic	2.25	"	2.50
Wool Tares, light...	1.75	"	2.00
Wool Tares, heavy..	1.80	"	1.90
Bright Bagging.....	2.25	"	2.50
Manila Rope—			
Foreign	4.25	"	4.50
Domestic	4.25	"	4.50
Jute Threads.....	3.00	"	3.25
Sisal Strings.....	2.00	"	2.25
Mixed Strings.....	.70	"	.85

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	2.75	@	3.25
Ordinary Hard White No. 1....	2.25	@	2.50
Soft White No. 1..	1.80	"	1.90
Soft White Extra..	2.50	"	2.60
Flat Stock—			
Stitchless	1.10	"	1.25
Overissue Mag....	1.00	"	1.10
Solid Flat Book...	.90	"	1.00
Crumbled No. 1...	.70	"	.75
Ledger White Stock.	1.55	"	1.65
Ledger Stock Colored	1.05	"	1.15
Manila—			
New Env. Cut....	1.70	"	1.80
New Cuttings.....	1.40	"	1.50
Old Kraft Machine—			
Compressed bales..	1.00	"	1.10
News—			
No. 1 White News	1.75	"	1.90
Strictly Overissue.	.70	"	.75
Strictly Folded....	.55	"	.60
Corrugated	.60	"	.65
No. 1 Mixed Paper..	.52½	"	.57½

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.18½	@	—
White Hemp.....	.18½	"	—
Fine Polished—			
Fine India.....	.23	"	—
Unpolished—			
Box	.14¾	"	—
Paper Makers.....	.15	"	—
Tube Rope.....	.16¼	"	—
Wall Paper.....	.15¾	"	—
Wrapping	.18	"	—
Soft Fiber Rope...	.16¼	"	—
Cotton	.21	"	—

(Hard Fiber)

Medium Java.....	.19	"	—
Mex. Sisal.....	.16	"	—
Manila	.24	"	—
Domestic	4.00	@	4.50
Sisal Rope	2.25	"	2.50
Mixed Rope	.75	"	1.00
Transmission Rope ..	3.00	"	—
Soft Jute Ropes.....	3.00	"	3.10
Jute Carpet Threads.	1.25	"	1.50
Gunny Bagging—			
Foreign	2.50	"	—
Domestic	2.10	"	2.25
Bleachery Burlap ...	3.00	"	3.50
Scrap Burlap—			
Foreign	2.40	"	2.50
Domestic	1.90	"	2.00
Scrap Sisal	2.25	"	2.35
Scrap Sisal for Shredding	2.50	"	2.60
Wool Tares, Heavy ..	2.40	"	2.50
New Burlap Cuttings	2.85	"	3.00
Aust. Wool Pouches.	3.25	"	3.50
Heavy baling bagging	2.65	"	2.75
Paper Mill Bagging..	1.25	"	1.50
No. 2 Bagging	1.10	"	1.25

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints...	.03¼	@	.03½
New White No. 1...	.08	"	.08¼
New Light Flannelettes	.05	"	—
Silesias No. 1	.05	"	—
New Black Silesias..	.03½	"	.03¾
Soft Unbleached....	7.50	"	8.00
Blue Cheviots	.05½	"	.06
Fancy	.02	"	.02½
Washable	.02	"	.02½
Cottons—According to grades—			
Blue Overalls	.05¼	"	.05½
New Black, soft ..	.03¼	@	.04
Khaki Cuttings	.02½	"	.03
O. D. Khaki	.03	"	.03¼
Corduroy	.02¾	"	.03
New Canvas.....	.06¾	"	.07¼
B. V. D. Cuttings...	.07	"	.07½

Domestic Rags (Old)

(F. o.b. Boston)

Canvas	.04¼	@	—
White No. 1—			
Repacked	—	"	2.75
Miscellaneous	2.50	"	2.75
White No. 2—			
Repacked	1.90	"	2.00
Miscellaneous	2.00	"	2.25
Twos and Blues	2.25	"	2.50
Old Blue Overalls ..	1.60	"	2.00
Thirds and Blues—			
Repacked	2.00	"	2.25
Miscellaneous	1.50	"	1.60
Black Stockings	4.00	"	4.25
Roofing Stock—			
No. 1.....	1.75	"	2.00
No. 2.....	1.60	"	1.65
No. 3.....	1.00	"	1.25

Foreign Rags

(F. o. b. Boston)

Dark Cottons	(nominal)
Dutch Blues	(nominal)
New Checks and Blues	(nominal)
Old Fustians	(nominal)
Old Linsey Garments.	(nominal)
New Silesias	(nominal)

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f.o.b. Phila.)

Shirt Cuttings—			
New White No. 1.	.07¼	@	.07½
New White No. 2.	.04	"	.04½
Light Silesias.....	—	"	.04½
Silesias, No. 1....	—	"	.04½
Black Silesias, soft	—	"	.03¾
New Unbleached..	.05½	"	.06
Washable, No. 1..	—	"	.04
Blue Overall.....	—	"	.05
Cottons—According to grades—			
Washable No. 2...	—	"	.02
New Blue	—	"	.02
Fancy Percales....	—	"	.03
New Black Soft...	—	"	.04
New Light Seconds	.04½	"	.05
New Dark Seconds	—	"	1.50
Khaki Cuttings—			
No. 1 O. D.....	.03½	"	.04
No. 2 Mixed.....	.03	"	.03¼
Corduroy	—	"	.02½
New Canvas.....	.05½	"	.06
New Black Mixed.	—	"	.03

Domestic Rags (Old)

White No. 1—			
Repacked	3.50	@	4.00
Miscellaneous	2.75	"	3.00
Thirds and Blues—			
Miscellaneous	2.00	"	2.25
Repacked	2.50	"	2.75
Black Stockings (Export)	3.50	"	4.00
Roofing Stock—			
Foreign No. 1....Nominal			
Domestic No. 1..	1.50	"	1.60
Domestic No. 2...	1.35	"	1.45
Roofing Bagging..	—	"	1.30

Bagging

(f.o.b. Phila.)

Gunny, No. 1—			
Foreign .....Nominal			
Domestic	2.50	@	3.00
Manila Rope.....	—	"	4.50
Sisal Rope.....	1.75	"	2.00
Mixed Rope.....	1.25	"	1.50
Scrap—			
No. 1.....	2.50	"	2.75
No. 2.....	—	"	1.40
Wool Tares, heavy..	3.50	"	3.70
Mixed Strings	.75	"	1.00
No. 1 New Light Burlap	3.00	"	3.50
New Burlap Cuttings	2.00	"	2.25

Old Papers

(f.o.b. Phila.)

Shavings—			
No. 1 Hard Write	2.25	@	2.30
No 2 Hard White	2.00	"	2.10
No. 1 Soft White	1.85	"	1.90
No. 2 Soft White	1.50	"	1.60
No. 1 Mixed.....	.90	"	1.00
Solid Ledger Stock..	1.50	"	1.60
Ledger Stock, white	1.30	"	1.35
Ledger Stock, colored	1.00	"	1.10
No. 1 Books, heavy..	.90	"	1.00
Manila Cuttings.....	1.90	"	2.00
Print Manila.....	.70	"	.75
Container Manila...	.65	"	.70
Kraft Paper.....	1.00	"	1.10
No. 1 Mixed Paper..	.55	"	—
Straw Board Chip..	.50	"	—
Binders Board Chip	.50	"	—
Corrugated Board...	.60	"	.65
Overissue News.....	.70	"	.75
Old Newspapers.....	.55	"	.60

BOSTON

Old Papers

(f.o.b. Boston)

Shavings—			
No. 1 Hard White	2.25	@	2.50
No. 1 Soft White	1.85	"	2.15
No. 2 Mixed.....	.75	"	.80
Solid Ledger Books..	1.30	"	—
Overissue Ledger Stock	1.30	"	1.50
Mixed Ledgers.....	.85	"	.90
No. 1 Books, heavy..	1.00	"	1.10
No. 1 Books, light..	.65	"	.75
Crumpled Stitchless Book Stock.....	.55	"	.65
Manila Env. Cuttings	1.70	"	1.85
Manila Envelope Cuttings, extra quality	2.35	"	2.60
White Blank News..	1.40	@	1.50
No. 1 Kraft.....	1.10	"	1.20
Mixed Papers.....	.52½	"	.55
Print Manila.....	.70	"	.75
Container Manila...	.60	"	.70
Old Newspapers....	.60	"	.65
Paper Wool Strings	.80	"	.90
Overissue News.....	.70	"	.75
Box Board Chips....	.52½	"	.55
Corrugated Boxes....	.60	"	.62½
Kraft corrugated boxes	1.00	"	1.05
Screening Wrappers	.60	"	.70

Bagging

(f.o.b.Boston)

Manila Rope—			
Foreign	4.25	@	4.50

TORONTO

Paper

Bonds

Direct mill shipment in two-ton lots.			
N. 1 White $35.50		@	—
No. 1 Tints	36.50	"	—
No. 2 White	25.50	"	—
No. 2 Tints	26.50	"	—
No. 2 Golden Rod..	27.50	"	—
No. 3 White	21.00	"	—
No. 4 White	15.00	"	—
No. 4 Tints	16.00	"	—
No. 4 Golden Rod	17.00	"	—
Direct mill shipment in three-ton lots.			
No. 5 White $10.50		@	—
No. 5 Tints	11.50	"	—
N. 5. Golden Rod..	12.00	"	—
No. 6 White	9.00	"	—
No. 6 Tints	9.50	"	—
No. 6 Golden Rod..	11.00	"	—
No. 7 White	8.00	"	—
No. 7 Tints	8.50	"	—
No. 7 Golden Rod..	10.00	"	—
Book—			
No. 1 M. F.	$7.00	"	—
No. 2 M. F.	6.50	"	—
No. 3 M. F.	5.35	"	—
No. 1 S. C.	7.25	"	—
No. 2 S. C.	6.75	"	—
No. 3 S. C.	5.85	"	—

Coated Book & Litho

Ton Lots (resale)

No. 1 .....$12.00		@	—
No. 2	10.25	"	—
No. 3	8.90	"	—
Coated tinted.....	13.00	"	—
Wrapping—delivered—			
Rag Brown.....	4.85	"	5.25
White Wrap.....	4.00	"	—
"B" Manila.....	4.90	"	6.15
No. 1 Manila....	$5.50	@	$6.90
Fiber	5.50	"	6.90
Kraft No. 2.....	5.50	"	6.90

(f.o.b. Cars, Toronto)

News per ton—			
Rolls (contract)..	46.00	"	—
Sheets	54.00	"	—

Pulp

Ground wood.....$36.50		@	—
Unbleached sulphite	54.00	"	—
Bleached sulphite...	64.00	"	—
Kraft	47.50	"	—
Soda	58.00	"	—

Old Waste Paper

(In carload lots, f.o.b. Toronto)

Shavings—			
White Env. Cut..	2.15	@	—
Soft White.....	2.00	"	2.15
White Blk. News..	1.35	"	1.50
Book and Ledger—			
Flat Magazine and Book Stock (old)	.90	"	1.00
Light and Crumpled Book Stock.....	.80	"	.90
Ledgers and Writings	1.15	"	—
Manilas—			
New Manila Cut..	1.55	"	1.60
Printed Manilas...	.76	"	—
Kraft	1.15	"	—
News and Scrap—			
Strictly Overissue	.75	"	—
Strictly Folded ..	.70	"	—
No. 1 Mixed Paper	.60	"	—

CHICAGO

Waste Paper

(f.o.b. Chicago)

Shavings—			
No. 1 White Envelope cuttings..	2.40	@	—
No. 1 Hard White	2.23	"	—
No. 1 Soft White	2.00	"	—
Ledger and Writings	1.20	"	—
Solid Books.....	.95	"	—
Blanks	1.70	"	—
Krafts	1.00	"	—
New Kraft Cuts.....	1.60	"	—
Overissue News.....	.80	"	—
Old Newspapers—			
No. 1 Folded News	.73	"	—
No. 1 Mixed Paper	.63	"	—
Roofing Stocks—			
No. 1	1.25	@	—
No. 2	1.15	"	—